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# THE GAS JOURNAL

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## *A Glance at the Contents—*

**Propaganda.**

In our Correspondence Columns Mr. W. R. Herring suggests that there would be no practical difficulty in issuing monthly returns of the Industry's production of gas. [p. 196.]

**Eastern Counties Association.**

A report is published of the autumn meeting of the Eastern Counties Gas Managers' Association, which was held in London on Oct. 14. [p. 204.]

**North London Exhibition.**

A fine display is staged by the Tottenham and District Gas Company, in co-operation with a number of leading firms in the Industry, at the Alexandra Palace, Muswell Hill. [p. 203.]

**"Fairy Gas" Competition.**

Newport (Mon.) children did well in the British Commercial Gas Association "Fairy Gas" Competition; in fact, they took 10 p.ct. of the prizes awarded throughout the country in this competition. [p. 200.]

**Better Lighting at Stratford-on-Avon.**

Improved street lighting has been carried out in some of the main streets at Stratford-on-Avon. "Windsor" type lamps (3 No. 2 mantles) have been replaced with 6-light (No. 2 mantles) "Rochester" lamps. [p. 201.]

**Hydrogenation.**

We publish a report of the discussion on Dr. Ormandy's paper at a joint meeting of the Institute of Fuel and allied organizations, including the Institution of Gas Engineers. Many interesting views on this important subject are expressed. [p. 209.]

**Hydrogenation and Coke Oven Gas.**

In our Correspondence Columns to-day Mr. L. H. Sensicle suggests that, while water gas—*plus* some producer gas—is an admirable source of hydrogen for synthetic ammonia manufacture, in which no gaseous contaminants arise to prevent re-circulation and maximum utilization of hydrogen, the coke oven gas method merits more favourable consideration for coal hydrogenation purposes. [p. 196.]

**Low-Temperature Carbonization.**

Criticism of Prof. H. T. Tizard's address on "The Future Possibilities of Fuel Utilization" before the British Association will be found in our Correspondence Columns to-day. The letters in question are by Mr. Harald Nielsen and Col. W. A. Bristow. [p. 197.]

**Distribution Superintendent for Rossendale.**

As will be seen from our advertisement columns, the Directors of the Rossendale Union Gas Company are inviting applications for the position of Distribution Superintendent at a commencing salary of £234. Candidates are required to have a sound theoretical and practical knowledge of distribution work, and ability to organize and control sales. [p. 215.]

**Producers for Retort Settings.**

This is the subject of a paper by Dr. E. W. Smith, Technical Director of the Woodall-Duckham Companies, at the autumn meeting of the Eastern Counties Gas Managers' Association. The major portion of the contribution concerns the merits of the step-grate producer, and a comparison is drawn between this type and the mechanical producer. [p. 204.]

**Benzole Recovery.**

In the course of a lecture on High-Temperature Carbonization at the Sir John Cass Technical Institute, Dr. E. W. Smith discussed the subject of benzole washing. With the advantage of the 8d. a gallon tax, carbonizing engineers would, he said, be examining more closely the economics of benzole recovery. In his opinion, much more benzole washing was justified than was taking place to-day. [p. 208.]

**Gas and the Building Industry.**

At a meeting of the Central Executive Board of the National Gas Council, a communication from the Secretary of the Advisory Council of the Building Industry was considered, inviting the Council to appoint a representative to be a member of a panel which was being set up to consider the legislation affecting the installation of heating, gas, and ventilation services in buildings. It was decided that a representative from the Gas Industry should be nominated as a member of the panel referred to. [p. 200.]

# EDITORIAL NOTES

## A National Fuel Committee

THE Joint Meeting of the Institute of Fuel and allied organizations held on Oct. 7 was not only the longest in the history of the Institute, but one of the most valuable. The subject discussed, hydrogenation and its bearing on the carbonizing industries, is of great national importance; and we feel sure that those readers—and they must be many—who found interest in our extract of Dr. Ormandy's paper last week will be equally interested in the report of the discussion which we publish to-day. Incidentally our Correspondence Columns should not be missed in this connection.

Apart from the question of hydrogenation, a resolution was passed at the meeting which closely concerns the Gas Industry. This resolution was in the following terms: "That the Institute of Fuel be requested to call together a Committee representative of those institutions largely interested in fuel, to act as a Standing Advisory Committee on all matters affecting the nation's fuel policy." We can take it that the National Fuel and Power Committee, which did such useful work, is now dead; and in spite of the fact that there seems no end to committee-making, there does appear to be a real need for a permanent Fuel Committee on the lines suggested by the resolution. The latter was put to the meeting by Dr. E. W. Smith, seconded by Col. W. A. Bristow, and received the blessing of Sir David Milne-Watson, who presided. We hope soon to give our readers more definite information as to the constitution and aims of the proposed Committee.

Dr. Smith made another suggestion—that the Fuel Research Board, as an entity under Government control, should be abolished. It is not that he does not value the work done by the Board; rather, that he is convinced that so much specialized industrial research has to be undertaken by each great industry that each industry, or group of industries, should be responsible for its own line of investigation. For example, research for the mining industry he would put into the hands of a research association for that industry; and he would make one organization responsible for the whole of the carbonizing research for the three industries—high-temperature carbonization, low-temperature carbonization, and coke ovens. An *ad hoc* body could deal with any "odd jobs." "At the present time," he said, "the researches carried out by the Fuel Research Board are to some extent isolated from the people who are mostly interested in the details of the problems that are being investigated." And for this reason he urges a review of the whole organization of the Fuel Research Board.

The Fuel Research Board has done excellent work for our own Industry, but some of the time occupied has been in duplication of investigation previously carried out by the Research Committees of the Institution of Gas Engineers. The influence of steaming in vertical retorts is an instance. Such inquiries are definitely special to the industry concerned; and although what may be termed an "impartial check" on experimental methods may be theoretically desirable, it may not be wholly necessary from the industrial, as distinct from the purely scientific, point of view. And in times such as we are passing through, immediate practical considerations must come first, and conservation of finances will have to go hand in hand with conservation of national fuel resources. Therefore we agree with Dr. Smith that "special" investigations should be left to particular industries. This idea does not in the least imply any belittlement of the value of the work of the Fuel Research Board. On the contrary, an organization such as this is, and will remain, essential to the scientific progress of the nation; our feeling is simply that its aim should primarily be to tackle in their early stages broad problems on a national basis. The Board's investigation of the potentialities of the hydrogenation of coal and coal oils alone affords ample proof of the need for its existence and exemplifies the type of work on which its energies might well be concentrated.

Turning now for a moment to the general discussion on Dr. Ormandy's paper, we would call attention to one or two of the interesting views expressed. Prof. Bone, for instance, put in a plea for coal as coal; he thinks that it ought to be possible to make coal do a great deal of what oil is doing at present, and he refuses to believe that it is beyond the resources of science first to de-ash coal substantially, and, secondly, to explode in an internal combustion engine a flower-fine de-ashed coal as well as we can explode an oil spray. It would certainly be amusing to see motorists calling for their bags of coal. Mr. W. M. Selvey, who spoke as representative of the Institution of Electrical Engineers, held out the hope that by hydrogenating tar it would be possible to produce sufficient oil to replace the imported oil at present employed for enriching blue water gas. This, he suggested, is a field for low-temperature carbonization which must be fostered by the Gas Industry. Col. Bristow, who maintains that hydrogenation and low-temperature carbonization are processes complementary to one another, exhibited samples of motor spirit to show what can be done with low-temperature tar. Dr. Ormandy, in spite of a speech by Mr. Gordon, of I.C.I., sticks to the view that it would be better to start commercial hydrogenation in a comparatively small plant (he suggests a 100-ton plant in two 50-ton units) than in a plant of the dimensions favoured by Mr. Gordon. These are only a few of the points selected as an indication of the remarkable interest attaching to the proceedings at this important meeting.

## Hard Facts

PROMISE and performance are often quite different things, and we have all along wondered just how closely one would approach the other in the case of the world-advertised Shannon Electricity Scheme. This huge undertaking may be freely admitted to be a splendid engineering feat, while at the same time all the difficulties in the way of commercial success are realized. Perhaps the principal of these difficulties, because it is one which cannot be removed, is the sparseness of the population in some of the areas over which the scheme is designed to operate; and, intensified by this difficulty, is the second difficulty, that the outlay on generation of necessity represents but a small part of the cost of distributed current.

The Shannon Scheme has been brought to a technically successful conclusion; but that is only one stage. After having been generated the current has to be sold on a commercial basis; and it is on this point that our doubts have centred. These doubts would appear to receive some support from statements lately published in the "Irish Press," whose Political Correspondent announces that the Electricity Supply Board have actually been considering the question of increasing electricity supply rates all over the Free State by anything from 7½ to 12½ p.ct. This step, it is understood, has been necessitated as the result of certain reports placed before the Board by their Auditors. The view of the Board's financial advisers is that the present returns from the scheme—despite its large volume of consumers—will not make it a sound economic undertaking, or a solvent business, unless the revenue is increased, and the only

method of securing this extra revenue is by increasing the charges. It is thought that such a step must prove tremendously unpopular all over the country, and particularly in Dublin, where there was a prospect of possibly cheaper rates if the Corporation undertaking had been left undisturbed.

Seemingly, when the question arose the Board were divided as to the necessity and economic value of such a step, and were unanimous that in any case there can be no increase in the rates charged to industrial undertakings. This would leave the whole of the extra burden to be borne by the private consumers, many of whom would probably change over to other methods of lighting, heating, cooking, &c., while new customers would be harder still to secure. The opinion that no increase is possible in the rates charged to industrial consumers may be read in conjunction with the statement by one big consumer that "even the special rate which has been given us for baking purposes at present works out at slightly more than the cost of gas." The Shannon Scheme conveys its lesson.

## *Producers Using Breeze*

"I KNOW of no more satisfactory way of making producer gas from breeze than the step-grate producer. No mechanical producer can touch it." This statement is made by Dr. E. W. Smith in a paper, published in this issue, which he read at the autumn meeting of the Eastern Counties Gas Managers' Association last week. His contribution is essentially a practical one, concerned primarily with outlining the methods by which step-grate producers can be efficiently operated—so efficiently, in fact, that modern vertical and intermittent retort settings can be run on a fuel consumption of less than 7 p.ct., where allowance is made for the value of steam raised by surplus heat. It is obvious from the paper that engineers will be well repaid if due attention is given to the routine operation of step-grate producers.

Emphasizing that ample producer capacity should, for several reasons, be attached to all carbonizing plants, the author states that a mean grate area ought to be allowed corresponding to the gasification of 10 lbs. of coke per sq. ft. per hour. If this advice is followed, then there arises no difficulty in utilizing breeze. The author defines breeze as coke which will pass through a $\frac{3}{4}$-in. mesh, and if this material alone is to be used, then his opinion is that the problems attached to its gasification are economically insuperable, though it is a simple matter, on a comparatively small grate area, to gasify $1\frac{1}{4}$ in. to $\frac{1}{2}$ in. But the problem before the gas undertaking is to work not on breeze alone, but on a mixture of coke and breeze; and a fifty-fifty mixture of coke above $\frac{3}{4}$ in. and coke below $\frac{3}{4}$ in. can now be employed in step-grate producers on the basis of grate area quoted. With an increase of grate area, and the air to the producer induced by a steam injector, this figure of 50 p.ct. breeze can be materially increased. It is easy to appreciate the savings which would result from the use of a mixture of fuel containing over 60 p.ct. of coke below $\frac{3}{4}$ in., since, for every ton of breeze employed, a ton of coke is rendered available for marketing. The author, who maintains that the mechanical producer cannot utilize smaller grades of coke better than the step-grate producer, sets out a cost comparison between equivalent mechanical and step-grate producers, from which he draws the conclusion that the cost of operating the latter is less than half that of running mechanical producers.

## *Tradition*

"IT would be well for administrators now and then to review their staff and find whether the advancement of the company is not being retarded by too great a reverence for tradition." This quotation is from the Presidential Address of Mr. W. L. S. Spinks to the Midland Junior Gas Association, and the idea expressed is well worth thinking about. "Tradition" can, of course, apply to an attitude of mind as well as to a method of carrying out work; and in the former sense our Industry would hardly be justified in holding its tradition as a trading concern in great reverence—note the phrase "as a trading concern." The fact has to be admitted that a new spirit was born in the Gas Industry in the early part of this century. Throughout the last century remarkably fine engineering progress was made in the manufacture of gas; in this respect the Gas Industry has a tradition of which it may well be proud. But in the matter of selling gas as a competitive fuel there is little of which to boast, and certainly nothing to reverence. The engineering tradition of our Industry is one of progress, which implies the use and encouragement of the creative mind. The "new spirit," too, is one of the use and encouragement of the creative mind on the sales side—the spirit of progress.

There is a great deal of leeway to make up before every gas undertaking in this country believes in the value of good gas salesmanship, and puts this belief into practice by raising the pay and the status of the gas salesman to its proper level. Gas salesmanship demands the exercise of the creative mind; and our Industry would gain a handsome financial profit if it offered better opportunities to young men of good education and keen minds. The advantage of safety of employment (an advantage obviously afforded by the Gas Industry) will not alone attract the right type of man—the man who has some measure of self-respect. This matter of self-respect is important. To make this clear, one has only to consider for a moment the records of those undertakings who regard their sales staff in the light which their potential worth merits. Such undertakings take their sales staffs into their confidence; they explain their policy; they ask for constructive criticism (and sometimes get it!); they aim at making their business a comprehensive unit; they encourage new ideas; they endeavour always to be in advance of the times.

Mr. Spinks offers certain criticisms of the present attitude of some gas undertakings towards their consumers; and with practically all these criticisms we are in full accord. He also makes several suggestions on how to increase sales. His Address is, in fact, a constructive essay; and at the meeting of the Midland Juniors he well deserved the compliments which were paid to him—in particular those of Mr. R. J. Milbourne and Mr. F. C. Briggs. As Mr. Milbourne said, we are fortunate in having Junior Associations the membership of which is not confined to the engineering side of the Industry, for this enables the young engineer to see the point of view of the young salesman. Mr. Briggs, by the way, said that if everyone took to heart the remarks of Mr. Spinks, the Industry would benefit. We share this view.

## Forthcoming Engagements.

**Oct. 23.**—GAS COMPANIES' PROTECTION ASSOCIATION.—Meeting of Committee, 5, Victoria Street, S.W. 1, 2.30 p.m.

**Oct. 24.**—MIDLAND JUNIOR ASSOCIATION.—Visit to Dudley Gas-Works.

**Oct. 24.**—SCOTTISH WESTERN JUNIORS.—Visit to Dalmarnock Power Station of the Glasgow Corporation Electricity Department.

**Oct. 24.**—YORKSHIRE JUNIOR ASSOCIATION.—Annual General Meeting.

**Oct. 30.**—INSTITUTION OF CHEMICAL ENGINEERS.—Meeting at the Institution of Civil Engineers, 6.30 p.m. Lecture by Dr. E. F. Armstrong on "Hydrogenation."

**Nov. 3-4.**—INSTITUTION OF GAS ENGINEERS.—Autumn Research Meeting.

**Nov. 5.**—MIDLAND ASSOCIATION.—Autumn Meeting in Birmingham.

**Nov. 12.**—MIDLAND ASSOCIATION.—Autumn Meeting in Birmingham.

**Nov. 17.**—INSTITUTION OF GAS ENGINEERS.—Session at the Public Works, Roads, and Transport Congress and Exhibition, Royal Agricultural Hall, Islington.

**Nov. 19.**—B.C.G.A.—South Wales District Conference at Swansea.

**Nov. 19.**—SOCIETY OF BRITISH GAS INDUSTRIES.—Autumn General Meeting, Hotel Metropole.

**Nov. 24.**—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Meeting.

**Nov. 25.**—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—General Meeting, Hotel Metropole, W.C., 2.30 p.m.

## PERSONAL

The latest information is, readers will be glad to learn, that Mr. J. F. RONCA continues to make good progress, and that the results of the operation appear to be very satisfactory.

Mr. JOHN A. MARWICK, who was trained under Mr. Thos. Carmichael, M.I.Mech.E., of Portsmouth, and who has recently been acting as Technical Assistant to the Portsmouth Gas Company, has been appointed to a post of Assistant Works Engineer with the Primitiva Gas Company of Buenos Aires, Ltd., and leaves to take up his new duties early in November.

The fifty years' service of Mr. ISAAC RICHARDS with the Cardiff Gas Company was recognized when he was presented recently by his colleagues with a mahogany clock and barometer. Mr. Richards' retirement took place in June. Mrs. Richards was the recipient of a wristlet watch. The presentations were made at the Bute Terrace offices of the Company by Mr. H. D. Madden, Engineer and Manager, and Mr. R. J. Auckland, Secretary. Mr. Richards started with the Company as a boy, eventually attaining, via every department, the position of Showroom Manager.

"Presented to JOHN MASON by the Directors of the Cannon Iron Foundries, Ltd., in commemoration of 50 years' faithful service." This is the inscription on a solid silver tea tray which the four Directors of the Cannon Iron Foundries, Ltd., Deepfields, Bilston, have presented to the Secretary (Mr. Mason), who on Saturday last completed half a century with the firm. In each corner of the tray is a facsimile of the signature of each Director. On Saturday Mr. Mason, in celebration of this event in his commercial life, took the office staff by motor coach to Lilleshall Hall, where the programme included the presentation by the staff of a set of books in a specially designed oak book-rest, suitably inscribed.

## OBITUARY

The death is announced of Mr. FREDERICK GIBSON (70), of Springfields, Bedworth, Chairman of the Bedworth Gas and Coke Company, Ltd.

# CORRESPONDENCE

### *Hydrogenation and Coke Oven Gas*

SIR,—I should like to call attention to the fact that the extract of Dr. Ormandy's paper in your issue of Oct. 14 perpetuates an error at which the author hinted in his introductory remarks—namely, the statement that "to convert coal into oil necessitates the addition of some 10 p.ct. of hydrogen to bring about the transformation." Dr. Ormandy arrived at this figure on theoretical grounds which he is doubtless ready now to admit are false. In actual fact, theory indicates that the conversion of coal into a 60 p.ct. yield of petrol of the type obtained by hydrogenation requires no more than the addition of 5 p.ct. weight of hydrogen, and any excess over this amount used in practice can be taken as evidence that such excess is not usefully employed, and is not at present recovered.

That 5 p.ct. of hydrogen is theoretically adequate can be deduced from the following facts:

(1) The yield of petrol obtained is 60 p.ct. by weight on the coal treated—*i.e.*, about 60 p.ct. of the organic coal substance is actually converted.

(2) The petrol is definitely aromatic and naphthenic in character, and so contains considerably less hydrogen than the 14 p.ct. postulated by Dr. Ormandy.

Obviously the production of petrol as end point requires more hydrogen than the conversion of coal into a crude oil for fractionation into lubricating, diesel, and other fuel oils; thus 5 p.ct. hydrogen should represent the theoretical maximum requirement in the extreme case of hydrogenation to petrol exclusively. In this connection it is of interest that Bergius originally suggested that the mere liquefaction of coal to crude oil might be made self-supporting as regards hydrogen requirements if the gaseous hydrocarbons such as methane and ethane yielded in the process were subsequently cracked to liberate their hydrogen.

*Apropos* the unavoidable production of such gases in the reaction chamber, it is at present inevitable that a quantity of hydrogen has to be allowed to escape from the high-pressure chamber when these accumulated reaction products are released. It is my present purpose to suggest that in a rational hydrogenation scheme, such as I recently indicated would be applicable to a coke oven installation, loss of hydrogen would be avoided by passing all gases released from the hydrogenation chambers to the coke oven gas stream at a point prior to the hydrogen separation plant. The unused hydrogen would thus be recovered for re-use, while the methane, &c., would go to swell the volume of high calorific value residual gas employed for oven heating, town distribution, or the like.

The preparation of hydrogen from water gas, as used at Billingham, involves, I believe, the catalytic preferential oxidation of CO to $CO_2$ and absorption of the total $CO_2$ under pressure by water. In this way a water gas containing (say) 50 p.ct. of hydrogen, and produced at a minimum cost of 6d. per 1000 c.ft., would yield hydrogen costing 1s. per 1000 c.ft. and nothing else (the cost of conversion and any counterbalancing yield of heat from the oxidation process being neglected). Coke oven gas from the plants in the Sheffield grid scheme is to be sold at ovens for 5½d. per 1000 c.ft., from which it is readily calculated that the hydrogen has a thermal equivalent value of 3¼d. per 1000 c.ft. Separation of this hydrogen by partial liquefaction methods involves the consumption of appreciable power, and fairly high capital charges, against which can be offset the possibility of recovering ethylene and 100 p.ct. benzole concurrently; but there is a margin of 8¼d. per 1000 c.ft. to cover the cost of separation and still leave the hydrogen as cheap as that from water gas. Furthermore the possibility of the recovery of unused hydrogen from the catalyst bomb by this method should not be forgotten.

It would appear that, while water gas—*plus* some producer gas—is an admirable source of hydrogen for synthetic ammonia manufacture, in which no gaseous contaminants arise to prevent re-circulation and maximum utilization of the hydrogen, the coke oven gas method merits more favourable consideration for coal hydrogenation purposes. The problem of surplus coke oven gas disposal is of sufficient magnitude and difficulty to justify very careful examination of this possible outlet, while the technical skill available in the bye-product coking industry might usefully be harnessed to this end on a wide scale, and lead to an inevitable improvement in the technique of hydrogenation in this country. The hydrogen available at a large proportion of coking plants should be adequate for the adoption of the process on a large scale at numerous centres.

L. H. SENSICLE.

*Artillery House,*
*Westminster, S.W. 1,*
*Oct. 17, 1931.*

### *Propaganda*

SIR,—May I venture to comment upon a paragraph under the above heading appearing in the last issue of the "JOURNAL" regarding the monthly publication of the Official Returns issued by the Electricity Commissioners showing the electricity generated by authorized undertakings month by month.

Regarding the Gas Industry, there is no practical difficulty in issuing similar figures relating to our own Industry. Every Undertaking could, on a postcard, supply at the end of each month to a central office—say, the British Commercial Gas Association—the gas produced monthly. This could be totalled at the central office and issued to the Press in the form of an interesting paragraph comparing it with the similar period for the previous year. To make the "mass of figures," either in therms or cubic feet, intelligible to the general reader, it could be reduced also to tons of coal, which all can appreciate, by dividing the quantity by the previous year's average, worked out from the Board of Trade returns.

Whether or not it might be carried further, and translated into the number of 10-ton wagons used, and the number of miners employed to win this coal, is a matter that might be considered, but I do feel that what you so aptly express as a "newsy" paragraph, can be easily compiled to the advantage of the Industry.

For the local Press there might be added to the paragraph the local figures, as well as other items of local interest, which would be following the present-day practice of the Press of keeping the public informed of the progress of such public services.

W. R. HERRING.

*St. Stephen's House,*
*Victoria Embankment, London,*
*Oct. 15, 1931.*

## *Coal from the National Standpoint*

SIR,—The importance of many of Dr. Ormandy's statements prompts me to enlarge on one or two aspects, for no other reason than to maintain public interest.

It is true that coal serving definite purposes as fuel is in a very convenient form if available as a liquid or even as a gas. From a national point of view, therefore, the liquification of coal is a matter of some urgency; whether by carbonization (high or low temperature) or by hydrogenation (high or low pressure) is a matter of detailed investigation. Whether attached to collieries, steel works, or gas-works—or even established independently—is a question to be treated as a technological problem in order to provide the desired economical results.

It has, for instance, been shown that the size of coke ovens and the quality of the coke has an important bearing on the cost of pig iron. If blending of coal and scientific control, conjointly with large-scale carbonization, can produce coke uniformity, and with it a reduced cost of ingots and finished steel products, then the value of the coke is higher. The gas can, therefore, be disposed of at a lower unit price.

In certain areas gas should then be available at a competitive price for use in gas engines, pumping electricity into the national grid. In this respect Ruhr conditions cannot possibly differ very materially from those obtaining in certain areas in this country. Capital costs of gas engines are high—£12 per KW. installed, exclusive of land and buildings—merely because the demand is limited. Size of units is limited to 7500 KW. merely because increased technical difficulties such as size of castings and transport outweigh corresponding reduction in general manufacturing costs. Again, hydrogen is extracted from coke oven gas by a cheap method, the remaining residual gas being returned to the internal gas grid of steel works or to other possible industrial uses. Technical science finds no difficulty in solving the problems of residual gas fired coke ovens. As, therefore, the cost of hydrogen for hydrogenation is largely bound up with size of unit, and as from the point of view of distribution of petrol a relatively small unit is desirable, the position outlined by Dr. Ormandy would justify the modernization of coke ovens not only for the benefit of the heavy industries, but for reasons of resultant increased national economy. Our national fuel remains our national wealth from ever-increasing angles of economic exploitation.

Dr. Ormandy's contention of co-operative processes is important; so important that, if expressed ten years ago, it would have saved much of the £7,000,000 "stripped" on low-temperature carbonization processes. Hydrogenation plants will have to be attached to coke oven batteries in a similar manner as low-temperature carbonization is to be used conjointly with coal gas carbonization.

Moreover, it seems that as regards progressive gas-works practice the hydrogenation phase will have to be linked up with the low-temperature phase for the completion of marketable liquid products. Gas-works are fully adequate to meet the growing demands of the community. Years ago the Gas Industry had the opportunity to secure statutory legislation for distribution of light and power from both gas and electricity. The opportunity went, and although gas and electricity have grown up complementary and not competitive, the two industries are not yet placed on a basis of real service without antagonism.

The relative position of imported mineral oils is different, but the Gas Industry should not repeat a similar mistake. Dr. Dunstan said we cry out against £44,000,000 petrol imports and not against £54,000,000 bacon imports. But we do. Now Dr. Ormandy draws attention to the important flexibility of hydrogenation with respect to the ratio of petrol and heavy oils. We see here a most valuable check to possible price manipulation by the oil companies. At the Fuel Conference, 1928, no doubt was left in our minds by Sir Robert Whaley Cohen that the production costs of the principal petroleum products were the same, and that the obtainable market prices were merely a function of supply and demand.

The co-operation of the oil companies during the present critical trade conditions is said to be sympathetic to industry. Yes, but which? If the advent of the high speed diesel engine raises—as it will do—the price of diesel fuels, the home fuel supplies can establish the economical balance by adjusting the petrol-heavy oil ratio. This must be most welcome news to the petrol engine industry and stem this senseless rush into production with all kinds of heavy-fuel high-speed diesel gadgets.

Dr. Ormandy warns us that the very valuable property of hydrogenized petrols counts against a diesel oil. Altogether it would seem that there is still a very long period of useful life in store for the petrol engine.

I suppose that if I could produce for Dr. Ormandy a low-compression ignition engine—pump and nozzle, and not carburettor, magneto, and sparking plug—Dr. Ormandy would supply a low-pressure hydrogenized universal fuel, eliminating the fire risk.

Dr. Ormandy's review has given so much food for thought that a few remarks on the question of lubricating oils from hydrogenation should have been added. I do not believe it was in this instance a case of "sins of omission."

J. L. CHALONER.

32, *Gainsborough Gardens,*
*London, N.W.* 11,
*Oct.* 19, 1931.

## *Low-Temperature Carbonization*

SIR,—The misfortune befell me of having to listen to Mr. Tizard's lecture at the Imperial College of Science during the recent British Association session, where one has to listen only, and no opportunity is afforded for discussion.

It is immaterial what private views Mr. Tizard may now hold regarding the low-temperature distillation or carbonization of coal, and his opinion is not the point in question; but that a former Secretary of the Department of Scientific and Industrial Research should express himself in the terms he did in regard to an industry of which, I am convinced, he knows very little, and of which, I am still more convinced, he is not in a position to judge from a commercial point of view, is absolutely staggering. From Mr. Tizard's remarks one cannot help wondering what were his views when he occupied the position of Secretary to the Department of Scientific and Industrial Research, and was therefore the head of the Fuel Research Board. If they were anything like those he expressed at the meeting in question, why did he sanction the expenditure of a million or more of public money on something which, according to him, is foredoomed to failure?

I have recently noticed that, whenever the subject of coal distillation is raised, various highly learned and academic gentlemen at once become equally great economists; or, in other words, if you will permit me to use the phrase, they talk through their hats on a subject of which they have no knowledge. Further, if I may venture a suggestion, would it not be better if they applied their undoubted abilities to constructive criticism, instead of wasting energy on criticism of a destructive nature, which will never carry us any further?

HARALD NIELSEN.

48, *Broadway, Westminster, S.W.* 1.
*Oct.* 15, 1931.

## *"Future Possibilities of Fuel Utilization"*

SIR,—In discussing the "Future Possibilities of Fuel Utilization," Prof. H. T. Tizard, Rector of the Imperial College of Science and Technology, has thought fit to make a number of sweeping statements, but without giving any facts in support.

If Prof. Tizard were practically associated in the working of any of the industries referred to, his remarks would naturally be entitled to respect, but when a Professor of Science breaks new ground and verbally wipes out of existence several promising industries, one surely has a right to expect some justification to be offered.

Not only is any detailed information lacking, but the general conclusions advanced seem open to suspicion. For example, it is stated that "domestic heating by means of electricity should be discouraged in the national interest, as it would be a gross and unjustifiable waste of national resources;" but no figures are given, and no reference is made to the increased thermal efficiency that very often attaches to electric heaters by reason of the fact that much of the heated air has not immediately to be led up a chimney and wasted. Further, the cost of gas production is kept at a low figure by reason of the fact that peak loads can be provided for by the heat accumulators at the gas-works—*i.e.*, gasholders. In the light of present knowledge there seems little reason to assume that the same basic principle cannot be introduced into electrical supplies, especially at the consumer's end.

With regard to hydrogenation, Prof. Tizard states that the "process could only be established on a large scale in this country under the protection of a tax which would virtually exclude for many years the competition of natural oil."

It is very evident that vulgar commercial news does not percolate into the august cloisters of the Imperial College; otherwise Prof. Tizard would know that there is already a tax of 8d. per gallon on petrol, that all home produced spirit is exempt from this tax, that the 8d. per gallon duty shows no signs of excluding foreign oil for many years to

come, and, what is more, the transport system of the country based upon petrol goes on without in any way being damaged by the preference in favour of the home produced article. What is more, this 8d. is probably quite sufficient stimulus for the hydrogenation industry.

Prof. Tizard then states that in his opinion this protective tax would be an economic mistake of the first order. As I have just shown, Prof. Tizard is rather uncertain of his facts, and this generalization is therefore robbed of much of its value, quite apart from which it is obvious that questions of national policy of this vital character could not, and should not, be decided in South Kensington.

In discussing the future of hydrogenation, Prof. Tizard remarks " What the final result will be *no-one could predict accurately* on present information." He then proceeds to predict " that the cost of hydrogenation is bound to be greater on a thermal basis than the minimum cost of producing electrical energy from coal." Why this passion for pessimistic prediction, in the face of his own statement that no-one could predict accurately on present information? Also what has the thermal efficiency of the generation of electrical current to do with the production of petrol from coal? This analogy is typical of the vague manner in which Prof. Tizard seems to have dealt with the whole subject.

It is, however, in connection with the manufacture of smokeless fuel that Prof. Tizard reaches his maximum degree of self-excitation. He makes a number of statements of a vague and contradictory character, but here again no evidence is advanced in justification of his charges.

Almost everything he says is wrong. His first statement is that low-temperature carbonization suffers from the fundamental disadvantage that the temperature is low. This, he states, leads to slowness of working and necessity for a larger size plant for a given output than is required in high-temperature carbonization.

First of all, I would point out that the two systems of high-temperature and low-temperature carbonization are not competitive; they are designed to make different products, and each system works at the temperature which best suits the products which have to be made. Incidentally, I would point out to Prof. Tizard that the time required for low-temperature carbonizing for the manufacture of smokeless fuel is four hours, which is about one-fifth of the time required for the process in the majority of high-temperature systems. Prof. Tizard is therefore both wrong in his facts and in his point of view.

His next statement is that " more important, the gas yield is correspondingly low." Prof. Tizard does not seem to know it, but this is what most of the manufacturers of smokeless fuel strive for, they do not wish to make a large quantity of gas, and the smaller they can make the yield the better they like it. The object in view is the conversion of small coal, mostly washed smalls, into the best household smokeless fuel having approximately the same composition and heat value as the most expensive anthracite. The operation of this process both from a technical and from a financial point of view is almost wholly unaffected by the gas production factor.

I am assuming that Prof. Tizard will not quarrel with the practice of using the small quantity of gas produced for heating the retorts, especially in view of his remark that gas is the cheapest method of heating.

Further on it is stated that " low-temperature tar is greatly inferior to natural fuel oil for the purpose of heating or power production," but here again Prof. Tizard either wilfully ignores or is unaware of the real facts. Low-temperature tar is not sold as a fuel oil, nor for diesel oil for power production; it is distilled into the various fractions of fuel oil, diesel oil, creosote, and other marketable portions.

In the House of Commons on March 11 last the First Lord of the Admiralty stated that Naval requirements for fuel oil were necessarily of a stringent character, but they had carried out a number of tests with low-temperature fuel oil, the results were satisfactory, and the Admiralty had determined to use a large quantity of low-temperature fuel oil in the future. It is also stated by Prof. Tizard that low-temperature fuel oil cannot be produced at a comparable cost. First of all, I would point out that the object of low-temperature carbonization is not primarily to produce fuel oil, but to produce smokeless fuel which constitutes over 70 p.ct. by weight of the residue of carbonization. The oil is a bye-product, and has to be disposed of at the best possible price in order to help the total yield.

I have never heard anybody claim that oil could be produced from coal at a price comparable with the price of oil which spouts from a hole in the ground, but that is no reason why the best possible markets should not be made for the bye-products, nor why they should not, if possible, be turned to national advantage.

Prof. Tizard, having by this time got all his facts wrong, proceeds to deliver judgment to the effect that the low-temperature carbonization industry as a self-contained commercial enterprise must be regarded as dead. Let us turn, therefore, for one moment, and see what the corpse is doing.

Since the beginning of 1928 several large commercial plants have been built and put into operation. Some of those plants have operated continuously from the date of their completion, two plants at least have been producing to their maximum capacity for over a year right through the summer and working 24 hours per day 365 days per year. The output of smokeless fuel in England has steadily increased, and whereas in 1927 there was hardly any trade or distributing organization, there are now well over 2000 distributors of low-temperature smokeless fuel, and it can be bought all over the country.

Three of the works have a capacity for dealing with 266,000 tons of coal per year. In 1929 a distillery was designed and built especially for the purpose of dealing with the increasingly available quantities of low-temperature crude oil. This distillery has worked continuously for over two years, and has produced many millions of gallons of coal oil products.

Incidentally, Prof. Tizard forgot to mention that the low-temperature process produces twice as much oil as the high-temperature process, and that the oil is very much easier to hydrogenate, crack, or distil.

Recent work has shown that the low-temperature oils can be readily hydrogenated at a comparatively low cost, the resultant yield being over 90 p.ct. by volume of very excellent motor spirit.

The smokeless fuel is widely popular, the public readily pay for it the highest price paid for any fuel for the open grate, and leading institutions have in the past two or three years given the highest possible awards to low-temperature smokeless fuel.

On May 5, 1931, the Secretary of State for Mines, in the House, made a long statement on coal policy, and detailed the manner in which the Government were prepared to assist any measures which might benefit the industry.

In respect to low-temperature carbonization the Secretary of Mines made the following statement:

> " I have given careful consideration in consultation with the Department of Scientific and Industrial Research with which my Department is working in the closest touch, to the question of how best the Government could assist the development of low-temperature carbonization and other processes for the scientific treatment of coal. The Government believe that the development of these processes should be encouraged, as their successful operation would be of benefit to the coal mining industry and to the country generally. Since 1927 substantial progress has been made with low-temperature carbonization, and certain processes are being operated on a commercial scale. . . . The Government desire to render assistance in the development of low-temperature carbonization. . . ."

Presumably the Secretary for Mines had the advantage of a report from the Fuel Research Board. I commend the whole statement to the earnest attention of everybody engaged in the industry, also to Prof. Tizard.

As Dr. Ormandy recently remarked in his now historic paper, never did a new process have to struggle for recognition in a worse period, and it is also equally true that never was there a greater need for new methods.

Contributions to the subject such as have been made by Prof. Tizard are, in my opinion, not only wholly unjust to the engineers and research workers engaged in these new fields, but, coming from the Rector of a National College of Science, are most improper.

W. A. BRISTOW,
Chairman.

*Low-Temperature Coal Distillers' Association of Great Britain,*
*28, Grosvenor Place, S.W. 1,*
*Oct. 19, 1931.*

## Dilution of Coal Gas.

Mr. R. G. Shadbolt points out three mistakes in our report of his remarks during the discussion on the dilution of coal gas at the meeting of the Manchester District Institution of Gas Engineers—see last week's " JOURNAL."

(1) p. 150, 2nd par., 6th and 7th line from end, for " coal instead of coke " read " coke instead of coal."

(2) p. 150, 4th par., 9th line, delete the word " Birmingham," read " over the whole year's supply.

(3) p. 150, 4th par., last line, after " purposes to which it was put " read " they could by these means obtain the necessary margin to effect complete aeration."

# THE NEWS OF THE WEEK

**Two Hundred Wash Boilers** have been installed since the beginning of the present year by the Martock and District Gas Consumers' Company, Ltd., an undertaking with about 1300 consumers.

**The Midland Association Autumn Meeting** will be held in Birmingham on Nov. 12, instead of Nov. 5 as already announced; the alteration of date being due to the postponement of the Autumn Research Meeting of the Institution of Gas Engineers.

**Whist Drives for Street Lighting.**—The cost of street lighting by gas at Great Longstone, a North Derbyshire Parish, is defrayed by voluntary subscriptions. Whist drives and dances to raise the necessary funds are enormously popular among the residents.

**A Special Show of Gas Cookers** and other gas labour saving devices is being made at the Newcastle "Evening Chronicle" Better Housing and Housekeeping Exhibition which was opened on Oct. 12 at the St. George's Drill Hall, Newcastle-on-Tyne, and continues until Oct. 24.

**The Halifax Gas Department** had one of the most attractive stands at a Trades Exhibition held during Halifax Publicity Week (commencing Oct. 10). The gasworks were among the various municipal undertakings thrown open to public inspection every afternoon during the week.

**An Electricity Failure** occurred the other night in parts of Hounslow, Osterley Park, and Isleworth. Shopkeepers carried on business by the light of oil lamps and householders hastily sought out candles. A night watchman supplied premises in Kingsley Road, Hounslow, with hurricane lamps.

**Cookery and Lighting Demonstrations** were held by the Yeadon and Guiseley Gas Company at the Town Hall, Yeadon, during the recent Health Week, and these were so popular that the Company are now continuing them for a second week. "Switch on the Gas" was the Company's advertising slogan.

**An Exhibition of Gas Appliances** was held recently by the Brighouse Corporation Gas Department at the Ambulance Hall, in co-operation with various leading manufacturers of domestic lighting, heating, washing, and cooking equipment. Lectures and demonstrations were given daily. This is only the second exhibition of the kind in Brighouse since the war. A special feature was made of the distance control switch.

**A Successful Exhibition** of gas cooking and heating appliances was recently held under the auspices of the Plymouth and Stonehouse Gas Company. The exhibition, at which modern examples of Parkinson cookers were in evidence, proved a great attraction locally, as over 3100 people attended it. During the period of the exhibition a series of practical cookery demonstrations was given by Miss H. H. Tuxford, M.C.A.

**The Kirkcaldy Town Council** have approved of a scheme submitted by their Engineer and Manager, Mr. James Kincaid, for modern showrooms and other accommodation. The scheme comprises the erection of new offices, both technical and administrative, new fitters' workshops and stores, together with an up-to-date showroom on the existing and adjoining site. Offers for the work were accepted, the probable cost being £3600.

**The Lowest Price on Record** for gas in Tiverton is to be charged as the result of a decision at a meeting of the Tiverton Town Council on Oct. 12. The Lighting Committee reported that the net profit of the gas undertaking for the year ended March 31 last was £939, and they recommended that the price of gas be reduced by 2d. per 1000 c.ft. as from the present meter reading, and also that a rebate of 10 p.ct. be allowed from the agreed charge for public lighting for the present year. These recommendations were adopted, and the Gas Manager, Mr. Corrigan, was congratulated on the satisfactory results. It was stated that the reduction of 2d. would bring the price of gas to 3s. 7½d. per 1000 c.ft.

**Examinations for Admission** as graduates and associate members of the Institution of Heating and Ventilating Engineers are held at suitable centres in January, May, and September each year. Intending Candidates should apply to the Secretary at 12, Russell Square, London, W.C. 1. The Institution was established in 1897, and its object is to promote and advance the science of heating and ventilation and kindred subjects. Application forms for membership may be obtained from the Secretary.

**At the Engineering Exhibition at Cardiff** being held from Nov. 18 to 28, Messrs. G. A. Harvey & Co. (London), Ltd., are showing an extensive range of perforated metals. This firm specialize in both perforated metal and woven wire suitable for screening, grinding, separating, and filtering purposes such widely different commodities as coal, coke, gravel, ore, sugar, food products. and fine chemicals. A selected range of ornamental patterns for radiator covers, pipe guards, grilles, and ventilating panels are also on view.

**The Twenty-Second Annual Exhibition** of Electrical, Optical, and other Physical Apparatus is to be held by the Physical Society and the Optical Society on Jan. 5, 6, and 7, 1932, at the Imperial College of Science and Technology, South Kensington. As on previous occasions, there will be a Trade Section and a Research and Experimental Section. The Section for the work of apprentices and learners is to be continued. The Trade Section will comprise the exhibits of manufacturing firms, and preliminary invitations to these exhibitors are being issued, entries being asked for by Oct. 28.

**The Public Works, Roads, and Transport Congress and Exhibition** is to be held at the Royal Agricultural Hall from Nov. 16 to 21, 1931, under the patronage of His Majesty The King. From the list of exhibitors, it is evident that a wonderful display of modern plant and machinery will be staged such as is used in the construction and maintenance of modern highways and the various other important engineering interests served by the Exhibition. So great has become the demand for space at this year's Exhibition that all available area at the Royal Agricultural Hall, including the newly constructed hall, adjoining the main hall, will be fully occupied by exhibits.

**A Very Successful Exhibition** of gas appliances with cookery demonstrations was held during Shopping Week in Merthyr Tydfil by the Merthyr Tydfil Gas Company in conjunction with Messrs. Richmonds Gas Stove Company, Radiation Ltd., Lighting Trades, Ltd., and the Horstmann Gear Company, Ltd. The cookery demonstrations, which were held twice daily, were very well attended by appreciative audiences, and, notwithstanding the depressed state of industry in the district, a number of orders for cookers, &c., were received. The low price at which gas is sold by the Merthyr Gas Company—viz., 2s. 4½d. per 1000 c.ft.—enabled the demonstrator to cook a full dinner for less than a pennyworth of gas.

## South Metropolitan Gas Company's Presentation to Territorials.

Extensive new headquarters for the 302nd Anti-Aircraft Searchlight Company of the Royal Engineers, T.A., were opened at Randall Place, Greenwich, on Saturday afternoon (Oct. 17) by Mr. E. V. Evans, Joint Manager of the South Metropolitan Gas Company, when the Union Jack was unfurled at the flagstaff.

Nearly a hundred men who come from all parts of London and are all members of the Gas Company were on parade under Major W. S. Borthwick. The unit was inspected by Major-General H. F. Salt, C.M.G., D.S.O., Commander of the Air Defence Formation of the Territorial Army, who expressed his gratitude for the generous support of the South Metropolitan Gas Company in presenting such a magnificent building to this Territorial Company.

## THE NEWS—*continued.*

### Council Wish to Purchase Brownhills Gas Company.

At a meeting of the Brownhills Urban Council on Oct. 14 last, it was decided to promote a Parliamentary Bill for the purchase of the Brownhills Gas Undertaking.

It was stated that the Cannock Gas Company was seeking power to acquire the Brownhills gas undertaking, and the Brownhills Council were of the opinion that the time was opportune to intervene and themselves obtain control, as such an opportunity might not occur for many years.

### National Gas Council.

#### Meeting of Central Executive Board.

A Meeting of the Central Executive Board of the National Gas Council was held at 28, Grosvenor Gardens, S.W., on Oct. 13—Sir DAVID MILNE-WATSON, LL.D., D.L., in the chair.

*Finance Act.*—The attention of members was called to the fact that the Chancellor of the Exchequer had recently stated in the House of Commons that the allowance for obsolescence on plant and machinery had been under consideration for some time, and that complaints had been made that too narrow a view had been taken in this respect. In future, he had stated, he proposed to take a more liberal view in regard to this subject, and in this way it was hoped to encourage the scrapping of old plant and its replacement with new.

*Rating.*—It was reported that the Rating Committee of the Council, at a meeting on Sept. 24, had discussed the Representations made to the Minister of Health by the Central Valuation Committee, and had agreed that one of these Recommendations—namely, that dealing with the circumstances in which an undertaking extending into several rating areas should be re-valued, or the cumulo valuation re-apportioned—was unsatisfactory. The Officers were accordingly re-drafting this Clause to meet the views of the Committee, and it would subsequently be submitted to the Gas and Electricity Joint Committee on Rating.

*British Association Meeting.*—The Chairman reported that he had taken part in a symposium on the British Fuel Problem in the Chemical Section of the British Association, and had contributed a Paper entitled "The New Gas Industry" to the Engineering Section. He had dealt with the British Fuel Problem from the point of view of coal only, while Sir John Cadman had discussed it from the point of view of oil. Mr. Tizard, Rector of the Imperial College of Science, had finally reviewed the whole subject, and his views, coming from an independent authority, were most interesting. It was agreed that the Council should circulate copies of the papers mentioned, which were being published in pamphlet form.

*International Illumination Congress.*—It was agreed that a letter of thanks should be sent to the representatives of Gas Undertakings and others who had contributed to the success of this Congress.

*Advisory Council of the Building Industry.*—A communication dated Oct. 10 from the Secretary of the Advisory Council of the Building Industry was considered, inviting the Council to appoint a representative to be a member of a panel which was being set up to consider the legislation affecting the installation of heating, gas, and ventilation services in buildings. It was decided that a representative from the Gas Industry should be nominated as a member of the panel referred to.

### Gas Heat-Treatment for Rheumatism.

On the stand of the Gas Light and Coke Company at the British Medical Exhibition at the New Horticultural Hall, Westminster, is one of the new Radiation clinical gas lamps.

In this lamp the gas is burnt in such a way as to produce a highly aerated bunsen flame. Combustion takes place within and on the outer surface of a refractory mantle coated with a material which ensures increased emission of short infra-red energy and the provision of heat of good penetrative value. The incandescent mantle is situated near the focus of a parabolic mirror, so that the emitted energy travels outwards in a slowly diverging beam. The material of the reflector has been selected to ensure low absorption of the higher frequency energy.

The lamp is mounted upon a well fitted stand, by means of a bracket, which permits of easy variation of the direction of emission of the stream of energy. The stand is of a suitable height and has a white enamelled base with tough rubber feet. A wooden grip is provided for convenience in adjusting the position of the lamp. The gas-supply passes through the centre of the handle, and if so desired the lamp can be removed and used apart from the stand.

Bombardment of the skin by infra-red energy results in a dilation of the capillaries and increased capillary blood-flow. It is the short infra-red energy which is the most penetrative and most capable of stimulating the blood-flow. The "biologic" effect of ultra-violet rays is widely known; it is not generally realized, however, that the visible energy and shorter infra-red rays have a definite "stimulative" value usually attributed to the power they possess of penetrating the epidermis. A high degree of flushing and sweating can readily be effected for an hour or even longer in comfort, provided the source of radiant energy employed is emitting heat rich in short infra-red rays.

Irradiation by the energy emitted by these lamps, by stimulating the capillary blood-flow, has been found effective in putting a stop to a severe eruption of acne and also in providing a useful palliative for persons suffering from rheumatism; relieving the pain, stiffness, and swelling.

Owing to the latent period between the treatment and the effect produced, ultra-violet irradiation should not be undertaken by laymen because of the risk of unpleasant after-effects. Infra-red energy treatment can be carried out without fear of accidental over-exposure.

The distance at which the heater should be placed from the patient varies from person to person and with the part of the body exposed. With normal adjustment of the gas supply it will often be found suitable to place the heater from 2 ft. to 2 ft. 6 in. distant from the patient. It is desirable to expose the patients to as high a concentration of energy as they can stand without undue discomfort. Treatment can readily be effected for an hour, or longer if necessary. Generally, it is found desirable to repeat the treatment two or three times a week, or even daily.

### Newport Children Do Well in "Fairy Gas" Competition.

Newport (Mon.) children did well in the British Commercial Gas Association "Fairy Gas" Competition; in fact, they took 10 p.ct. of the prizes awarded throughout the country in this competition. Twenty-five Newport children won national prizes, but in addition the Directors of the Newport Company awarded another 50 money prizes. The total entries from Newport were more than 600, from children between the ages of 5 and 16. There were senior, intermediate, and junior sections. The seniors wrote essays, the intermediate did colouring of a set picture, and juniors did needlework. Many of the entries were well done, and the judge's opinions were high of a few.

Mr. J. F. Rust, Assistant Engineer to Newport Gas Company, presided at the presentation of the awards, and he and Mr. W. Stanford (Secretary of the Company), who presented the awards, expressed the pleasure the Directors had in organizing the competition. The results had been gratifying.

### Society of Chemical Industry.

#### Birmingham and Midland Section.

The first meeting of the Birmingham and Midland Section of the Society of Chemical Industry was held on Tuesday, Oct. 13, at the Chemical Theatre at the Edgbaston Buildings of the Birmingham University. The lecturer was Prof. Gilbert T. Morgan, D.Sc., President of the Society, a past-Chairman of the Birmingham Section, and formerly the head of the Chemical Department of the Birmingham University.

The subject was "The Chemistry of Low-Temperature Tar." In extending the knowledge of the chemical nature of low-temperature tar, methods of extraction have been adopted which avoid the use of distillation processes at high temperature. The speaker dealt with the question of the systematic use of inorganic reagents and organic solvents for extraction below 120° C., giving details of methods used and study of a typical tar; the isolation and identification of chemical entities of the olefine, aromatic and naphthalene series involving the preparation of certain higher phenols and synthesis of authentic specimens of various hydrocarbons; he gave the results of a study of eighteen varieties of low-temperature tars; spoke on their physical and chemical properties and reviewed the potential uses and industrial applications of low temperature tar.

Sir Richard Threlfall stated that the establishment of the national research laboratories at Teddington, of which

Prof. Morgan is the Director, was due largely to the foresight of Sir Arthur Balfour, who with Sir Frank Heath and himself approached the Treasury, who made a grant. The Research work, in its various phases, was thoroughly co-ordinated.

Those taking part in the discussion were Dr. E. D. Mason (who presided), Prof. W. N. Haworth, Prof. Nash, Mr. T. F. E. Rhead, Mr. D. W. Parkes, and Mr. W. A. Benton.

The following is the programme for the ensuing session: Dr. W. E. Smith on the "Production of Electricity from Town's Refuse;" Messrs. J. and M. Beilby and W. Nelson on "Case Hardening and Heat Treatment of Steels;" Mr. E. Gordon Cox on "Application of X-Ray Methods to Chemical Problems," and Mr. W. R. Barclay on "Some Characteristics of Nickel and Its Alloys."

The Annual Dinner, under the auspices of the various chemical societies, will be held on Feb. 6.

## "Coal Mine to Road."

One hundred and fifty surveyors from London, Middlesex, Surrey, Kent, Sussex, Buckinghamshire, Bedfordshire, Hertfordshire, and Essex saw "From Coal Mine to Road," the talking film produced by the British Road Tar Association, which was shown at a luncheon at the Hotel Metropole at which Mr. Reginald G. Clarry, Chairman of the British Road Tar Association, presided.

The film will be shown to local authorities and surveyors, and in schools and colleges all over Britain. It takes about twenty minutes to show, and a shorter version lasting about five minutes, called "Tar," will be exhibited in several hundred cinema theatres.

Some of the most interesting "shots" in the film show the effect of motor car wheels on a smooth surfaced road during rain. The wheels skid violently, but, on a properly laid tar-macadam surface, the wheels grip in spite of the film of moisture.

## The Croydon Gas Company.

A further "Potential Investment" figuring in a recent issue of the "Financial Times" was that of the Croydon Gas Company, whose steady expansion of business is referred to.

The Croydon Gas Company, it was stated, was incorporated by the Special Act of 1847 as the Croydon Commercial Gas and Coke Company, and the present name was adopted in 1904. In the following year the Caterham and District Gas Company was acquired, and a Board of Trade Order is now awaited to take over the Oxted and Limpsfield Gas Company as from Jan. 1, 1931.

The statutory area at present covers about 75 square miles, comprising good class districts offering abundant scope for the expansion of operations owing to their rapid development. The record of the undertaking is one of continuous growth, new consumers and sales showing a steady yearly increase, so that its prospects are very promising.

A summary of the residual products sold during the last four years follows:

| Year to Dec. 31. | Coke. | Breeze. | Tar. | Ammonia (Liquid). | Sulphate of Ammonia. |
|---|---|---|---|---|---|
| | Tons. | Tons. | 1000 Galls. | Galls. | Tons. |
| 1927. . | 76,995 | 26,301 | 1778 | 7 | 1825 |
| 1928. . | 80,910 | 20,502 | 1777 | 176 | 1897 |
| 1929. . | 88,221 | 20,932 | 1916 | 1 | 1634 |
| 1930. . | 91,739 | 15,166 | 2099 | 7 | 2040 |

In respect to the same period the financial results were:

| Year to Dec. 31. | Paid-up Capital. | Balance of Revenue Account. | Sliding-Scale Stock. | Maximum Dividend Stock. | To Reserves. |
|---|---|---|---|---|---|
| | £ | £ | P.Ct. | P.Ct. | £ |
| 1927. . | 1,310,660 | 152,568 | 6¾ | 5 | 16,889 |
| 1928. . | 1,310,660 | 155,008 | 7 | 5 | 20,000 |
| 1929. . | 1,360,660 | 164,983 | 7 | 5 | 17,000 |
| 1930. . | 1,360,660 | 164,851 | 7 | 5 | 10,984 |

On account of the current year interim dividends of 3½ p.ct. and 2½ p.ct. on the two stocks respectively were paid on Sept. 1.

## *THE NEWS—continued.*

## Better Gas-Lighted Streets.

Improved street lighting has been carried out in some of the main streets at Stratford-upon-Avon. "Windsor" type lamps (3 No. 2 mantles) have been replaced with 6-light (No. 2 mantles) "Rochester" lamps.

The following recommendation was included in the minutes of the Sanitary and Highways Committee which were presented for confirmation at the Council meeting on Oct. 13: "Instructions were given that the Superintendent of Police should be consulted with regard to the necessity of continuing the flood lighting of the car park in Rother Street, as the Committee feel that the park is now sufficiently illuminated by the ordinary street lighting." This was carried, and Councillor Lawson commented on the excellent lighting since the new lamps were erected.

The flood lighting is electric, and was installed just over twelve months ago. When the electric flood lighting is discontinued the street lighting will be 100 p.ct. gas.

## American Gas Convention.

The Convention of the American Gas Association took place, for the third consecutive year, in the Auditorium at Atlantic City, New Jersey, from Oct. 12 to 16. During the Convention there was an Exhibition of Appliances and Equipment, said to be the largest in the history of the American Gas Industry.

At the Technical, Industrial, Natural Gas, Commercial, Publicity and Advertising, Manufacturers', and Accounting Sections, valuable papers were presented and discussed, particular interest attaching to the Presidential Address of Mr. Clifford E. Paige, who outlined the practical application of the second of the five-year Programmes of the American Gas Association, which now becomes operative.

A most cordial welcome was given to Mr. J. Herbert Canning, President of the Institution of Gas Engineers, who, having conveyed the greetings of the Institution to the American Gas Association at the opening General Session on Tuesday, Oct. 13, read a paper at the Technical Section on "The British Gas Industry."

The opening of the Convention happened to coincide with the meeting of the Council of the Institution, which sent the following cablegram to Major Alexander Forward, the Managing Director of the American Association:

> Assembled Council of British Institution of Gas Engineers sends cordial greetings to members of American Gas Association, best wishes for successful Convention and future prosperity and kind regards to President Paige, President Canning, Sir Francis Goodenough, and yourself.

Mr. Canning was privileged to assist the President and Mrs. Paige in receiving the guests at the President's Reception at the Hotel Traymore on Tuesday, Oct. 13.

Mr. Canning, who had already paid an official visit to the Canadian Gas Association in Toronto, where he was received and entertained by the President and other Officers of that Association, leaves New York by the SS. "Laconia" on Oct. 17, which is due to arrive in Liverpool on Oct. 26.

## New Season's Fletcher Fire Catalogue.

The interesting gas fire catalogues regularly published by Messrs. Fletcher Russell & Co., Ltd., are always masterpieces in attractive design and production, and the latest booklet recently issued is no exception, containing as it does many beautiful impressions in colour of artistic gas fires and surrounds.

Particular attention is drawn in this publication to the two outstanding features of the Fletcher standard gas fires—namely, the "Injector-Ventilator," which changes the air of the room several times in the hour, securing thorough ventilation of the apartment without draughts; and the "Beam" radiants by which a soft heat is attained, giving a bright fire, attractive in appearance, and one that heats up rapidly.

The attractive art finishes of many of the Fletcher fires combine delicacy of appearance with permanence in use, and they require no cleaning beyond an occasional light rub over with a soft cloth. A wide range of fires is described and illustrated in the new catalogue, of which particular mention may perhaps be made of the "Hamilton," "Rodney," and Stanley," supplied in a number of finishes, including old gold, silver, and copper bronze. Further attractive fires are exemplified in the "Burleigh," "Bosco-

## THE NEWS—*continued.*

bel," and "Sunbeam" appliances. A section is also devoted to inset gas fires, with and without dogs.

A final page describes the Nautilus "Marblate" suites, which are eminently suitable for installing where an attractive fireplace is required, and where low cost is an important factor in the choice. They are supplied in wood or marble finishes. Nautilus "Marblate" has actual slate for a base. The finish, which is durable, is stove enamelled and many of the most beautiful and expensive marbles and woods are reproduced with surprising exactness and without the blemishes that occur so frequently in the actual materials. Fletcher gas fires can be fitted to Nautilus "Marblate" suites, and the colour of both suite and gas fire can be chosen to produce a most attractive ensemble.

# REVIEWS

### BRITISH EMPIRE TRADES INDEX.

The Publishers of Sell's Directory of Registered Telegraphic Addresses (Business Dictionaries, Ltd., 8 and 9, Johnson's Court, London, E.C. 4) have just issued a British Empire Trades Index, which will be sent free for the cost of postage to the leading firms in trade throughout Great Britain and the British Dominions Overseas. The volume is to be issued annually, and it should serve a useful purpose when firms within the British Commonwealth of Nations desire to have a handy reference book of leading firms of the whole Empire.

The book is specially compiled for manufacturers and merchants who desire to extend their connections "within" the Empire.

Telephone numbers and cable addresses are given, and the Post Office has contributed an interesting article on the Romance of the Telephone. A foreword in the form of a message has been contributed by Sir E. T. Crowe, K.C.M.G., Controller-General of the Department of Overseas Trade. The book contains interesting particulars from the respective Dominions and India, and there are about 600 pages closely printed of names and addresses and businesses, &c., of Empire traders.

The result of great labour and expense, this book, with its guaranteed distribution of 25,000 copies, should prove of value to those who desire to push their selling to the utmost limits of the Empire. The house of Sell is to be congratulated upon its enterprise.

### THE CHEMISTRY OF COAL.*

The three main sections of the book are devoted to peat, lignite, and coal respectively, and the author deals with the origin, properties, composition, structure, reactions, thermal decomposition, and inter-relationship of these types of fuel and with their classification. The treatment covers palæo-botanical, geological, petrographic, physical, and chemical aspects, and is comprehensive in scope, if not in detail, and up-to-date. The subject matter covers a wider field than the title indicates, and the book will therefore appeal to a large circle of readers of widely varied interests.

Many references are to be found to investigations published even this year, and it is a satisfactory feature that the work of investigators in countries other than Germany receives adequate recognition. The author has himself carried out many investigations on the constitution of peat and on lignin and other substances contained in it.

That the fundamental aspects of the subject are dealt with rather than the technical aspects in no wise detracts from the merits of the book. It is, indeed, an advantage, since fundamental principles are too often neglected.

In a work of this kind one might have expected to find a large number of illustrations and photomicrographs, but the author has not included any. Possibly this defect may be remedied in future editions. It is evident that much care has been devoted to the presentation of accurate information, and it is therefore surprising to find on p. 280 that the heat of combustion of pure carbon is 9440 calories.

* "Die Chemie der Kohle," by Walter Fuchs. (Berlin, 1931, Julius Springer. Pp. VIII. + 510. Price, R.M. 45 bound.)

### DIVIDEND INCOME-TAX TABLES.*

The rate of tax is 5s. in the £ from April 6, 1931, but as many deductions were made at 4s. 6d. in the £ before the Finance (No. 2) Act was passed, a deduction of 5s. 6d. is required from a similar payment to make 5s. in the £. These income-tax tables show not only the amount to be deducted from dividend and interest payments, &c., but also the net amount after such deduction has been made, thus simplifying the work of clerks in writing out warrants and cheques.

* Dividend Income-Tax Tables for the Use of Secretaries, Bankers, Accountants, &c. Published by Effingham Wilson, 16, Copthall Avenue, E.C. 2; price 1s.

## Successful Showmanship

*Views of the Leicester Gas Department's stands at the Home Life Exhibition held in Leicester in September last. The Department's effort was crowned with success, for it aroused great interest among the many thousands who visited the Exhibition.*

# GAS AT THE NORTH LONDON EXHIBITION

## A Fine Display by the Tottenham and District Gas Company in co-operation with a number of leading firms in the Industry at the Alexandra Palace, Muswell Hill

A more prominent display of gas apparatus than has ever been staged at this Exhibition before was to be seen at the sixth Annual North London Exhibition at the Alexandra Palace, Muswell Hill, opened on Oct. 14 by the Lord Mayor of London, Sir Phéné Neal.

### The Gas Pavilion.

The "Gas Pavilion," as it was most appropriately called, consisted of a very large stand at the East Entrance of the Exhibition arranged in sections by the Tottenham and District Gas Company in co-operation with a number of leading firms in the Industry. Besides the apparatus actually displayed by the Gas Company there were many separate yet co-ordinated displays of ranges of other firm's gas appliances. Around the walls of the stand were a number of excellent gas slogans.

The most outstanding feature of the Main display was an entirely new design of panel gas fire in a beautiful green imitation marble surround and with artistic copper-work embodied in the design. Examples were shown of gas fires in "Manu-Marble" mantels, which is a worked stone giving a most attractive, cheap, and hard-wearing surround. Two water heaters were shown—the "Omnia" in stainless finish and the "Twin-Thermae" in white enamel—by the Omnia Manufacturing Company. This latter is an interesting apparatus in that it holds two gallons of water heated by the main burner at the bottom, while above is a further two gallons which can be drawn upon if required, and which is heated by the waste heat from the lower part.

In addition to a wide range of attractively finished cookers from the cheaper variety to the high-grade eye-level type, there were examples of "Mainscreen" gas fires, which in warm weather, when the fire is not required, act as a fire screen to cover up the unsightliness of the empty coal grate; also radiators, including the "Cinemain," in gold finish, which is suitable for public halls, cinemas, &c., where the flame is not exposed and is inaccessible. The "Romain" panel heater was also shown, this apparatus being safe for use in garages.

Further sections of the gas stand displayed a variety of high-grade fires and cookers, including the "Alpine New World," "Bungalow," and "Kingsway" series. A bath-room exhibit was also staged showing 3¾ gallons per hour "Sunhot" boiler, "Ascot" basin heater and "White Chief" geyser, together with a heated towel rail.

A section devoted to Messrs. William Sugg's products displayed types of "Red Sphinx" fires, the "Berkeley" cooker, and the firm's latest types of gas poker.

The Parkinson Stove Company were showing their "Jewel" geyser, "Indusa" heater, "New Suburbia" cooker in various coloured enamel finishes, and the "Newpark" cooker with "Ajusto" automatic oven heat control, together with the "Tottenham" water heater and "Pearl" geyser in chromium finish.

There was also an interesting display of different types and sizes of mantles as manufactured by the Welsbach Light Company. Continuous demonstrations were in progress with "Dean" washing machines, aided by gas irons and the "Eco-Dry" clothes drying cabinet (described recently in the "JOURNAL"). Messrs. Ewart & Son were showing examples of their geysers, including "Vivo" and "Brilliant" models, while an attractive model in blue finish was designed to harmonize with a bathroom suite of the same colour.

### A Potterton Display.

The section devoted to Messrs. Thomas Potterton's appliances included a selection of the latest appliances for automatic hot water and central heating. On the hot water side there were examples of the "Empire" and "Emperor" gas heaters with luminous burners and bi-metal thermostats. The "Emperor" boiler is similar to the "Empire," but has an insulated steel jacket. They are finished in celluose or vitreous enamel, and as such form a useful companion to the modern enamelled cooker which is now becoming so popular. As an example of complete equipment the "Emperor" thermal storage set is exhibited together with the "Empire" lagged storage set, the former being rectangular and therefore eminently suitable for positions where space is limited.

As example of central heating installations the Victor R. 6 boiler was included, this apparatus being complete with base tray, automatic bi-metal thermostat with dial regulation, governor, and flue baffle. An interesting adjunct to this stand was a set of photographs illustrating various examples of heating installations carried out by this well-known firm.

### Coke.

The coke side was not forgotten, and excellent examples of the bright and glowing domestic fires to be obtained by the use of gas coke were shown in Kempton and "Metro" grates, fitted with gas ignition burners. An interesting exhibit compared the new and old types of kitchen apparatus side by side—on the one hand the old, dirty, and inefficient coal range and on the other the modern way with the help of an enamelled gas cooker in a recess with an "Ideal" domestic coke boiler. The simplicity of conversion from the old-fashioned fireplace to the coke grate was also demonstrated.

The lighting of the whole stand was very efficient and showed examples of the latest and most attractive fittings, most noteworthy of which, perhaps, were the "Whitehouse" coloured glass fittings. The lighting was controlled by means of Horstmann and Sugg distance switches. Continuous cookery demonstrations were also in progress, which attracted large crowds.

As a result of the success of the doughnut frying at the recent carnival in which the Tottenham Company took part, the Golden Ray Cake Company took a stand at the Palace, and, with the help of gas apparatus carried on the same process as before but on a larger scale, and again attracted large crowds. A gas fryer was utilized for frying the doughnuts, while gas was also used in the proving ovens and for driving the gas engine which actuated the cutter.

### Messrs. Hobbs Wilson's Stand.

Messrs. Hobbs Wilson, of Wood Green, who do a considerable amount of work in connection with the "Ideal" radiators, again had a prominent stand. Chief among the exhibits was a new model "Ideal" gas boiler for central heating or indirect hot water supply. Complete combustion of gas and absorption of heat is ensured by the special features in their construction. The luminous flame burners prevent gas and air mixing in the burner so that the possibility of back-firing is eliminated. The air necessary for combustion mixes with the gas in the well proportioned combustion chamber, resulting in quiet fan-shaped flames. The draught diverter prevents excessive draughts or down-draughts. Automatic gas control is provided to avoid overheating and consequent waste. The ground edges of sections ensure gas tight joints. All flue surfaces are easily accessible for cleaning. The boiler occupies little space and is fitted with insulated jacket to conserve heat. The light grey and black enamel finish gives it a handsome appearance. The particular boiler on the stand was feeding a "Rayrad" panel heater.

An interesting model house with glass walls and floors showed how a dwelling should be piped completely for gas hot water circulation and heating, different colours indicating the flow and return pipes. Various cookers and other gas apparatus besides coke boilers were also to be seen here, while an imitation antimony surround and hearth made from metallized slate was an interesting new feature.

### Other Exhibits.

A large number of firms were using gas on their stands for one purpose or another, while some were showing various small types of gas apparatus.

The New Winterflood Geyser Company, of Finsbury Park, were displaying a number of their geysers, including the "Ideal," "Finsbury," "Onward," "Everflow," and others. In most of these models the construction is of copper, polished and lacquered, with fittings in brass. The base, body, top, and boiler are each detachable, and the burner and condensation tray are both made in copper so as to prevent rust and corrosion. Incidentally this firm specialize in repairs to all types of geysers.

Altogether this Exhibition was an excellent one from the gas standpoint, for, good as the gas exhibits have been in previous years, the "Gas Pavilion" on this occasion struck a new note and succeeded in illustrating the versatility of gas in a very admirable manner, which could not fail to impress visitors to the Exhibition. The Tottenham Gas Company and those firms who co-operated in the production of this effort are certainly to be congratulated.

# THE "JOURNAL" TECHNICAL RECORD

*Which contains Reports of Meetings of Gas and Allied Associations.*

## Eastern Counties Gas Managers' Association

The Autumn Meeting of the Association was held in the Board Room of the National Gas Council, Grosvenor Gardens, S.W., on Wednesday, Oct. 14—Mr. J. GREEN, of Wisbech (the President), in the chair.

The HON. SECRETARY AND TREASURER (Mr. E. F. Keable, of Gorleston, said he regretted to have to announce the death of Mr. R. S. Tobey, who was for many years a member of the Association. They had also since the last meeting lost their esteemed friend Mr. Wimhurst, who was one of the founders of the Association. There remained now only Mr. Barton, of Peterborough, in this connection. Mr. Barton had had the misfortune to lose his wife. Suitable letters of condolence had been written.

On the suggestion of the President, the members, as a mark of respect, stood silently in their places.

The following additions were made to the roll of the Association:

*Members.*—Mr. Andrew Kellard, Secretary of subsidiary Companies to the British Gas Light Company; and Mr. A. L. Higham, of King's Lynn.

*Associate Members.*—Dr. E. W. Smith, Technical Director, Woodall-Duckham Companies; and Mr. F. B. Richards, Managing Director, Woodall-Duckham Vertical Retort Company.

To Mr. E. J. Fillery, of Newark, was presented a certificate gained in the recent Higher Grade Examination in Gas Engineering.

Mr. E. ABLETT (President of the Wales Association) expressed his pleasure at being present. He remarked that some years ago he had met Mr. Walmsley, the President-Elect, and he heartily wished him a happy and successful year of office.

### PRODUCERS FOR CARBONIZING PLANTS.

By E. W. SMITH, D.Sc., Technical Director, Woodall-Duckham Companies.

It is universal practice in the Gas Industry to-day to heat carbonizing plants by means of producer gas made from coke. Only by such means is it possible to vary the heats with any precision and vary the position of the heats.

In the coke oven industry coke ovens are usually heated by means of coal gas, the coal gas being the bye-product of the industry and coke the main product. When the gas is sold for town's purposes or for industrial use the price obtained is not such as to justify the introduction of producers, and the consequent liberation of coal gas. There is no instance in this country of coke ovens being heated by means of producer gas made in external producers, although at the present time there is one installation of coke ovens nearing completion which is so designed that it may be heated by means of blast furnace gas having a calorific value of 1000 B.Th.U. or less per c.ft.

#### HEATING SETTINGS WITH COAL GAS.

Calculations have been made in the past as to whether or not it would pay some gas undertakings at certain periods in the year to heat their settings with coal gas. This would be practicable if the price received for coke was high enough to justify the change-over in certain periods of the year. Such a policy is almost unthinkable to-day when the prices received for coke, tar, and ammonia are at such a low figure. It is conceivable, however that a time may come when it will pay to use coal gas as an adjunct to the heating system of the carbonizing plant. A useful purpose would be served if someone would prepare a statement showing under what conditions, and at what time, this state of things would be justified.

I am concerned, however, in this contribution to confine myself entirely to the heating of carbonizing plants by means of producer gas made from coke. This gas is made by burning coke with air under correct conditions. In other words, when air is passed through a sufficiently deep bed of coke at a correct temperature, the carbon of the coke combines with the oxygen of the air, and carbon monoxide is formed. It is believed that the first reaction is the direct formation of carbon dioxide, and that a secondary reaction of carbon dioxide *plus* further carbon gives carbon monoxide. The oxygen that is used is always associated with four times in its volume of nitrogen, and consequently for every volume of carbon monoxide produced in this simple reaction there will be eight volumes of nitrogen. However, coke is not pure carbon, and some methane is found in the resultant gases, not usually more than 1 p.ct. At the same time coke is never dry, nor is the air which passes through the bed of fuel, and even when no water or steam is deliberately added to the air or the producer, there will always be a small percentage of hydrogen present, this being produced by the interaction of water and carbon, giving hydrogen and carbon monoxide in the main.

Coke is also always contaminated with ash, and this ash has a varying fusion point. Some ashes fuse at as low a temperature as (say) 1100° C.; other ashes are infusible below 1300° C. This is an important factor, because the producer bed must be a good gas-making unit through the whole volume of its capacity. If the temperatures rise too high the ash fuses, clinker is formed, first in small nodules which then adhere together and form larger pieces, a treacly mass develops, air is prevented from passing through that zone of the fire, more air is forced up through the rest of the fire, a vicious circle is formed, and serious interference takes place of the gas-making conditions.

To obviate such conditions as these it has become the almost universal practice to allow steam to pass with the air through the producer bed. The reaction of steam and carbon is definitely one in which heat is absorbed and not developed, as is the case in the reaction between oxygen and carbon. The temperature of the fuel bed can be reduced to any desired degree by admitting varying quantities of steam with the air through the producer. This steam can be deliberately admitted as steam under the bars of the producer, or if the step-grate type of producer, which I will describe later, is used, water can be allowed to trickle from step to step to soak the coke or ashes in contact with the step, and, because of the warmth of such ashes or coke, it will be evaporated and pass forward with the air.

#### WATER COOLING OF FIREBARS.

Under such conditions it is obvious that there will be a tendency for more steam to be present in that air which passes through the bars at the top of the grate than towards the bottom of the grate, and it is frequently noticed that when too little water is allowed to trickle on to the top bars the bottom part of the fire is hotter than the top part of the fire. If more water is added until it may be seen to be dripping from the bottom step, then in all probability a great deal too much steam will be passing through the bed of fuel with the air at the top of the grate. There is also a tendency for too much water to drip from the bottom bar under such conditions, and so to develop what is called a wet ash pan. This is not advisable, because a great deal of fuel is in contact with the bottom of the producer, and the steam will be admitted through the bed of fuel in positions where it is not wanted, and the temperature of the producer itself will vary considerably from zone to zone.

To overcome such difficulties various methods have been adopted for introducing a combination of water and steam. It can be taken that it is invariably good practice to allow sufficient water to fall on to the top step of the grate to keep a black fuel bed at least half way down the steps. It then may be advisable to introduce steam through (say) ¼-in. pipes projected from the side walls across the face of

the steps at about a zone from 2 ft. up the producer steps to the base of the steps, the main quantity of steam being at the base. Many producers are working under such conditions quite satisfactorily, but it will be realized that there is no exact method of controlling the proportions of air and steam passing through the bed of fuel.

A much more satisfactory method is to introduce the whole of the air underneath the coke bed by means of a steam injector. In that way the whole of the air passing through the coke bed is intimately and evenly mixed with a known quantity of steam which need not vary in its steam-air composition whatever. It has been found that under the conditions in which the step-grate producer is designed and used the quantity of steam which will keep down all clinker troubles, except under very special conditions, does not need to exceed ½ lb. of steam per pound of coke gasified.

### The Step-Grate Producer.

Many types of producers have been evolved in the Gas Industry during the last twenty or thirty years. I do not intend to occupy your time in describing all these types. Suffice it to say that the most satisfactory producer with which I have come into contact is that of the step-grate type. This has been evolved by a process of "trial and error" combined with a thorough understanding of the effect of various changes, and to-day it can be safely stated that under the conditions of operation in the British Gas Industry such producers can be operated without any of the troubles known and described as "clinker troubles." The old days of spear bars and of bolstering up the fuel bed while huge pieces of clinker were fished out at the base are, or should be, a thing of the past.

There are hundreds of producers working to-day without any clinker troubles whatever. In fact, clinker cannot be found in the producers. At regular intervals during the 24 hours the producer is pricked, and ash scraped from the bars. The ashes are also periodically shovelled from the producer pan. The general design of the step grate is well understood. It consists of a series of steps so arranged that at the angle at which it is fixed no coke can fall out of the producer. Arrangements are made for water to drip from step to step, consequently the steps should be practically horizontal, with a tendency to sag in the middle if anything. Such producers are working with and without producer doors. Although the cost is increased by the cost of producer doors, I am strongly in favour of their use. This enables complete control of the admission of air and steam to be maintained.

In designing the producer the aim should be to secure even working over the whole grate and to avoid hot spots.

The normal step-grate producer as designed for continuous and intermittent verticals is built in refractory material without steel casing, with cast iron fittings, and has a large coke hopper capacity within the producer itself. This arrangement is attained by the design of the gas offtake being protected from the coke storage by means of a curtain arch.

### Requirements of a Producer.

I believe all carbonizing engineers will agree with me when I state that the chief requirements of a producer attached to a carbonizing plant are:

(1) That it shall be capable of using coke from any class of coal that is likely to be used for gas-making.
(2) That producer gas shall be of satisfactory quality and quantity under the conditions of pull that are available in the setting.
(3) That it shall be free from clinker troubles.
(4) That it shall have a reasonable life as regards the steps and the producer lining.
(5) That it shall be accessible to operate, clean, and repair.

The refractories in the producer that come into contact with the coke and its ash, and are subjected to critical temperatures, must be the best that are available. After a long experience with such producers I have come to the conclusion that, taking everything into account, it is difficult to justify any other material than that of first-class firebrick. I am aware that a great deal of experimental work is going on at the present time in order to determine whether other grades of refractory material might not show up to better advantage. I have no doubt that there are many materials which will last longer, but they are usually very expensive, and if the firebrick lining can be made to last for two years or more, without it having to be renewed, there would appear to be little justification for the use of materials which cost two and three times as much, even if the cost of the renewal, apart from materials, be taken into account.

Most failures of producer linings can be traced to accidental causes. If the operators are experienced and conscientious in the execution of their work, most failures are eliminated.

Practically all producers operating in the Gas Industry may be termed suction producers—namely, they depend for their admission of air on the pull exerted by the stack attached to the carbonizing plant. This is true even if steam injectors are used under the bed of the producer, as such injectors only overcome the back pressure thrown by the restricted entrance for air through the injector, and possibly relieve the vacuum under the grate to a certain extent. Because it is essential that all carbonizing plants shall be worked with the least amount of vacuum in the combustion chambers, that will enable the right amount of secondary air to be admitted to the combustion chambers, it is therefore necessary that all producers shall work under the least possible pull conveniently practicable. This is one of the reasons why ample producer capacity should be attached to all plants, and it is now accepted by my own Company that a mean grate area shall be allowed corresponding to the gasification of 10 lbs. of coke per sq. ft. per hour. Should it be desired to use coke of a smaller grading, then a larger grate area is provided.

It will be readily understood that the back pressure thrown by small coke is greater than that thrown by larger coke. As the back pressure, broadly speaking, should be a constant figure, the grate area should vary with the class of coke that is used. However, producers must be built to be able to deal with fairly wide ranges of sizes of coke, and the figure of 10 lbs. per sq. ft. can be taken as a good mean figure.

Another dimension which is of importance is that of the depth of the fuel bed itself. In the step grate producer which I am describing, and which is standard practice in many plants, the depth of the fuel bed may be taken as being an average of 5 ft. 6 in. This is a normal depth in producer practice. In mechanical producers it is less, but after much experimenting it is found to be the depth which gives the best results under very widely varying conditions. If small coke or breeze were to be burnt in step-grate producers entirely, then it might be advisable to reduce the depth of this bed, and it could conceivably go down to 3 ft.

A producer designed along the lines I have indicated would give a producer gas having a composition as follows:

| | P.Ct. |
|---|---|
| $CO_2$ | 7 |
| CO | 26 |
| $H_2$ | 12 |
| Methane | 0·5 |
| $N_2$ | 54·5 |

expressed as dry gas.

The characteristics of this gas can be seen from the following table:

*Producer Gas.*

| | Hand-Operated Producers. Coke. |
|---|---|
| Composition (p.ct. by vol.)— | |
| $O_2$ | .. |
| $CO_2$ | 7 |
| $C_nH_m$ | .. |
| CO | 26 |
| $H_2$ | 12 |
| $CH_4$ | 0·5 |
| $N_2$ | 54·5 |
| Assumed composition of $C_nH_m$ | .. |
| ,, ,, ,, $CH_4$ | $CH_4$ |
| Specific gravity (air = 1) | 0·90 |
| Theoretical air requirement, vol. per unit vol. | 0·952 |
| Theoretical waste gases, vol. per unit vol.— | |
| $CO_2$ | 0·335 |
| $H_2O$ | 0·130 |
| $N_2$ | 1·297 |
| Total wet | 1·762 |
| Total dry | 1·632 |
| Total $CO_2$ content of dry waste gases, p.ct. | 20·5 |
| Volumetric composition of wet waste gases, p.ct.— | |
| $CO_2$ | 19·0 |
| $H_2O$ | 7·4 |
| $N_2$ | 73·6 |
| Dew point of waste gases, °C. | 40 |
| C.V. at 30 in. 60° Fahr. saturated— | |
| For the gas— | |
| B.Th.U. per c.ft., gross | 126·1 |
| ,, ,, ,, ,, net | 119·6 |
| For theoretical mixture— | |
| B.Th U. per c.ft., gross | 64·6 |
| ,, ,, ,, ,, net | 61·3 |

From the figures that have already been given, engineers will be able to calculate out for themselves the grate area that should be allowed with our present ideas per ton of coal carbonized, when account is taken of the fuel consumption. This type of producer is extremely efficient. It is supported by ample thickness of brickwork surrounded by firebrick of an insulating type. The producer gas leaves the producer and is admitted to the carbonizing

plant at temperatures of the order of 850° C. Under these conditions the efficiency of the producer is over 90 p.ct. When ashing out of the producer is conducted with normal care, the amount of carbon in the ashes should never be greater than 25 p.ct. Under these conditions the loss in the ashes is less than 2 p.ct. of the fuel used.

This producer gas, having a calorific value of 119 B.Th.U. net per c.ft. on the dry gas, requires about 0·95 c.ft. of air per c.ft. of producer gas. It is usual to admit approximately 10 p.ct in excess of this figure. The waste gases under these conditions, immediately after combustion, would contain 19·4 p.ct. of carbon dioxide, 1·2 p.ct. of oxygen, and 79·4 p.ct. of nitrogen. It is quite possible to run under these conditions, and lower carbon dioxide figures are frequently caused through the admission of air after the waste gases leave the combustion chambers.

The heating system of all carbonizing plants should always have plenty in hand, and should be designed to work under the worst conditions. It is therefore advisable in working out the theoretical requirements of the producer capacity, fuel consumption, stack pull, &c., that a temperature of 1500° C. should be attainable. Now cold producer gas when burnt with cold air cannot possibly give 1500° C., although the theoretical flame temperature of such a mixture is about 1600° C. The actual effective temperature attainable approximates to 1250° C.

To ensure a flue temperature of 1500° C., the temperature of the air when the temperature of the gas is at 850° C. would have to be raised to 150° C. This is attained by slight recuperation. More recuperation than this is not necessary from the point of view of attaining the necessary heats. Further recuperation only saves fuel.

If the temperature of the producer gas were to be no higher than 450° C., then the air would have to be heated in the recuperator to 450° C. instead of the 150° C. mentioned previously.

It will be noted and realized that this producer gas is not capable of giving a flame temperature anything like so high as either water gas or coal gas. A convenient way of expressing the value of a gas from the point of view of flame temperature, rough though it may be, is to add together the volume of theoretical air required to a cubic foot of gas, and divide that into the calorific value of the gas.

Such a producer gas/air mixture as we have been discussing would have a calorific value of 61·3 B.Th.U. net per c.ft. of mixture. The figure for coal gas and water gas is nearer 100, depending on the composition of the gases.

High recuperation is considered to make for fuel economy, but elaborate recuperators of the necessary area for the conservation of the maximum quantity of heat from the waste gases can only be obtained by courting serious risks of leakage in the setting. The simpler and smaller the recuperator, the less chance will there be of an unbalanced setting and consequent leakage.

### Waste-Heat Boilers.

This question of heat conservation by the use of efficient recuperators is one of secondary importance where waste-heat boilers are employed. The waste gases leaving the settings can pass through well-lagged mains to the waste-heat boilers, and a much greater quantity of heat can be conserved in the waste-heat boiler than is possible in any practicable recuperator. It is only on works where steam is not required that such considerations do not count. I know of none, however; and if allowance be made for the value of steam on quite a conservative basis, expressed as coke that would have been used in order to raise the steam, modern vertical and intermittent retort settings are in many cases to-day being run on a fuel consumption of less than 7 p.ct.

Waste-heat recovery is not worth while unless the waste gases are at a temperature higher than 450° C. If engineers find that their waste gases are lower than this figure, it would be well to check up the carbon dioxide content of the waste gases. If it is low, it is advisable to look for air infiltration, which can nearly always be eliminated, and the temperature of the waste gases will be proportionately increased.

It is interesting to note that where a carbonizing plant has a fuel consumption of 14 p.ct. without allowance being made for the waste-heat boiler expressed as dry coke, the evaporation of steam per ton of coal carbonized obtained in the waste-heat boiler will be as follows:

| Temperature of Waste Gases. | Steam Produced from and at 212° Fahr. | Steam from 60° Fahr. at 120 Lbs. Pressure. (No Superheat.) |
|---|---|---|
| °C. | Lbs. | Lbs. |
| 800 | 1350 | 1120 |
| 900 | 1620 | 1340 |
| 1000 | 1950 | 1620 |

There are just two other points that I would like to deal with. The first is the question of breeze utilization in producers, and the other is that of the application of mechanical producers to retort settings.

### Breeze Utilization.

Coke is the most valuable asset after gas that the Industry has. The value of coke is over 50 p.ct. of the total of any gas production including coal. Consequently the lower the fuel consumption the more coke there will be for sale, and the more of the lower priced coke that can be used on the works the greater will be the proportion of the higher priced coke available for sale.

For many years past attempts have been made to devise apparatus in which coke breeze can be used for the production of producer gas. There is no difficulty about making producer gas from such breeze if sufficient grate area is allowed, and the depth of the fuel bed is properly reduced. The grate area will have to be increased in direct proportion as the size of the coke breeze is reduced.

For my purpose I have in mind that coke breeze can be assumed to be all that coke made which will pass through a $\frac{3}{4}$-in. mesh. In other words, its size can be termed $\frac{3}{4}$ in.-0 in. There is no difficulty in gasifying $\frac{3}{4}$ in.-$\frac{1}{2}$ in., all the $\frac{1}{2}$ in.-0 in. being eliminated. It is quite an easy thing on a comparatively small grate area to gasify $1\frac{1}{4}$ in.-$\frac{1}{2}$ in., but the problems attached to the gasification of material from $\frac{3}{4}$ in.-0 in. are in my view economically insuperable if that material alone is available.

Coke as made may contain up to 15 p.ct. of material below $\frac{3}{4}$ in. There is no difficulty in using such coke in the standard dimensioned producer. In fact, subject to certain precautions being taken the proportion of $\frac{3}{4}$ in.-0 in. material can be increased under normal working conditions up to about 50 p.ct. mixture—namely, half $\frac{3}{4}$ in. and above, and half $\frac{3}{4}$ in. down. It is necessary that the grate area under such conditions should be at least equivalent to 1 sq. ft. per 10 lbs. of mixture gasified.

I believe that it is possible materially to increase this figure, subject to the grate area being increased and the air to the producer being induced by means of a steam injector. In order that the whole of the breeze shall be utilized when the fuel account is 14 p.ct., it is necessary that the mixture shall contain over 60 p.ct. of material below $\frac{3}{4}$ in. When such a result is obtained it means that for every ton of breeze used, valued at about 5s., there is a ton of coke available for sale valued at (say) 25s. The effect of this utilization on the economics of gas production is marked.

I know of no more satisfactory way of making producer gas from breeze than the step-grate producer. No mechanical producer can touch it. It would be necessary for the mechanical producer to be capable of utilizing a great deal more breeze than the step-grate producer before the increased costs of the mechanical producer could be justified. I am of the opinion that it would fully repay all the experimental work that can be carried out on it in an endeavour further to utilize breeze in the step-grate producer. The chief requirements as previously stated are ample grate area, air under positive conditions of mixture with steam, and a suitable depth of fuel bed.

### The Mechanical Producer.

One of the defects in the past of the step-grate hot gas producer has been that in the older designs of carbonizing plant some of the fine ash which is liberated during gas production in the producer has been carried forward to the combustion chambers, and with the development of temperatures of the order of 1400° C. this ash has tended to fuse on the control dampers. Even if fusion did not take place, where high ash coals are used—particularly in Scotland—this ash has gradually made up the recuperators which have periodically to be cleaned. This is not a difficult question, but it is a great inconvenience. Of course, a great deal depends on how the producers are ashed out. Careless ashing out can cause many times the amount of ash to go forward to the combustion chambers and recuperators. With a properly designed routine and execution of the ashing out, the dust trouble can be very largely minimized.

However, in the later type of producers and carbonizing plants, the hot gas mains connecting the producers to the carbonizing plant have been so designed as to enable the big bulk of the fine ash to settle out, and be run away from the ash traps. Much consideration has been given to ideas that have been put forward, patented and otherwise, for ash separating plants at the outlet of the producers. So far all such systems have failed because they absorbed too much pressure, and if they had been introduced then the vacuum in the combustion chambers would be greater than it is advisable to carry.

The most satisfactory solution has been the proper dimensioning and design of the horizontal mains between the producer and the carbonizing plant. In the future the step-grate producer may be operated in a different way from that which has been usual up to date.

It has been thought in the past that the only way to overcome dust trouble from the producer, and to obtain absolute control of heating conditions on the setting, is to feed the setting with gas made on a mechanical producer, the producer giving gas under pressure, the gas being cleaned and distributed as required. It has been felt that, owing to the high output per sq. ft. of grate area of the mechanical producer, and the reputed low labour costs, the mechanical producer should be a cheaper proposition than the step-grate producer.

I have had occasion to examine this subject many times during the last ten or fifteen years, and so far I have found no justification whatever on over-all cost for the introduction of the mechanical producer, and no contributions to the Technical Press in recent years have in any way shaken that conclusion.

I should like to put before you some rough basic figures which, even if only approximately accurate, will be sufficiently indicative of the relationship between the cost of running a mechanical producer with a step-grate producer.

If we take as a basis a plant that requires gasification of 45 tons of the make of retort coke per day in mechanical producers, complete with waste-heat boilers, gas coolers, air blower, and gas exhausters, with building foundations, instruments, &c., then three 8 ft. 6 in. producers would be required. The capital cost is estimated at £22,000. Labour can be taken as 10s. per shift, amounting to £3 per day. Maintenance and supplies must be included, and water at 6d. per thousand gallons. The cost per year is as follows:

| | |
|---|---|
| Capital charges at 8 p.ct. | £1760 |
| Labour | 1080 |
| Maintenance and supplies | 500 |
| Water | 220 |
| Total | £3560 |

The capital cost of a similar sized step-grate producer complete with foundations is estimated at £4250. Labour at 10s. per shift would amount to £3 per day. Flue cleaning can be taken as £56 per year. Maintenance and supplies at £100. The cost per year would be:

| | |
|---|---|
| Capital charges at 8 p.ct. | £340 |
| Labour | 1080 |
| Flue cleaning | 56 |
| Maintenance and supplies | 100 |
| Total | £1576 |

It can be taken, therefore, that the cost of operating step-grate producers will be something less than half that of running mechanical producers. In the case of step grates we have hot producer gas with some nuisance as regards flue cleaning, while with mechanical producers we have cold gas, which will require some producer gas recuperator area but no flue cleaning.

Even if the mechanical producer side be simplified, there is a good margin for reduction before the mechanical producer is even equal to the step-grate producer in over-all cost of operation.

If it is suggested that the mechanical producer can utilize smaller grades of coke better than the step-grate producer, I fear that the facts are against it.

I think I have said sufficient to indicate that engineers will be well repaid if close attention is given to the routine of operation of step-grate producers. It is probably one of the most lucrative sides of carbonizing operations. There is a necessary technique, however, which must be followed if the best results are to be obtained. The technique does not call for elaborate training or experience, but it must be followed. Systematic returns should be made. They will amply repay the closest study.

### Discussion.

Mr. H. C. Smith (Tottenham) remarked that when the author began to speak about mechanical producers, it recalled to his (the speaker's) mind the rather trying time which he had for five or six years when he had to work mechanical producers. He was absolutely in agreement with Dr. Smith when he said that his firm had made up their minds that the very finest producer there was to-day was the particular type of step-grate producer they were using. He himself had had experience of many kinds of producers, but he had never yet had to work a producer so admirable in every respect as this step-grate producer. He had had mechanical producers heating an installation of vertical retorts erected during the war. He had to commence to work them about 1920, and the fuel consumption at that time was, he thought, about 30 p.ct. They never had the heats they wanted, either in quantity or regularity, and this was because they were endeavouring to work breeze in these producers. It was impossible to get satisfactory heating when working breeze in these mechanical producers. They experimented with various grades of coke, and finally found that, when they cared to use coke ¾ in. to 1¼ in., they could get their heats: so they did this. But, at the same time, they, together with the other London Companies, were endeavouring to push their coke sales in connection with the growing use of domestic boilers, and it was not very long before they discovered that the fuel they were using on their mechanical producers was the very fuel for which they could obtain top prices in the domestic market. They then decided that the cheapest fuel for use in these producers was unscreened coke, just as they would have used on the step-grate producer. They had, however, all the difficulties of getting rid of the ash, and they were real difficulties. Another thing was that they were losing heat, when the producers were away from the retort settings and there was a considerable length of main. To try to use mechanical producers on coke without recovering heat by means of waste heat boilers between the producers and the retort settings was a failure, compared with the results one could get from a good step-grate producer. He had not had any experience with the more modern mechanical producers with waste heat boilers, but the only possible advantage he could see in these was the absence of clinker troubles. As, however, with properly designed step-grate producers clinker troubles were also eliminated, one was really taking up the additional ground space necessary for mechanical producers when one could get the same results with a step-grate producer incorporated in the setting. When a few years ago they were faced with the need for the reconstruction of this plant, and consulted Dr. Smith's firm, it was found that they could, on the same site, using the same ironwork, reconstruct their plant with the same number of retorts, and in addition incorporate step-grate producers, leaving the space occupied by the mechanical producers free for installing further carbonizing plant, when it might be desired. A very careful estimate proved that, with the saving in fuel guaranteed for the step-grate producers, it would pay them to put the mechanical producers out of action altogether. This estimate had been fully justified. He did not want to be unfair to the mechanical producers, and, as he had already said, he had not had experience of modern ones, but he could not see how even these could compare with the efficient step-grate producer that was available.

Mr. J. G. Stewart (Letchworth) said that in a paper on steel manufacture he found enormous variations in B.Th.U. in the producer gas per pound of carbon in the coke; in one case the figure was about half what it was in another. The only explanation he could think of was that it might be due to bad poking of producers, and air leaking through. Did this form of inefficiency occur in step-grate producers?

### Exhaust Steam for Producers.

Mr. P. D. Walmsley (Great Yarmouth) remarked that at his works some years ago they had cause to consider the remodelling of the carbonizing plant, and they put in a self-contained producer which was not a step-grate. They had considerable trouble with this type of grate, but they determined that if it was a success in other places it would have to be made a success in Yarmouth. Everything turned on the regulation of the steam to the producer, and what they did now was to collect all their exhaust steam on the works, and conduct it into a receiver. The supply was taken from that receiver and controlled by a pressure regulator. It was a patented plant. They were getting excellent heats and low fuel consumption. The fuel consumption, he thought, was at the present time not more than 10 p.ct.

### Producer Linings.

Mr. W. Grogono (Croydon) said the author had referred to producer linings, and he would like to hear more about Dr. Smith's view on the question of the best material to use. This was an important point about producers, which were so excellent to-day, except for the lifetime of the producers being less than that of the retorts they were heating. At Croydon, they were now lining their producers without letting the settings down.

Mr. W. Surman (Braintree) also referred to the question of lining producers, and remarked upon the fact that producer gas is being used for the dilution of coal gas.

Mr. T. V. Johns (Lowestoft) raised the question of temperature in the combustion zone, saying that he was under the impression that the figure for the maximum splitting up of air and steam was 1000°. The author stated that the proportion of air and steam did not vary with the increase of steam at the injector. His own experience was that the more steam one put on the injector, the greater was the percentage of air in the mixture.

Mr. F. B. Richards (London) remarked that, where it was practicable, it would pay to weigh producer fuel. Of course, this could not be done when charging hot coke, but where cold coke was used it would generally pay well to keep a closer control. The difference between coke made and coke sold was accounted for partly as fuel used on works, and partly as producer fuel. The separate control of these two factors was well worthy of attention.

Mr. W. B. Farquhar (Ilford) said he thought that the coke could be left to look after itself, provided the producer was worked properly in all respects. If this were done, the coke would come out right in the end.

Mr. R. G. Shadbolt (Birmingham) asked what was the fundamental difference between the step-grate and another grate the bars of which would be on the same slope as the steps, but running from front to back instead of across. He had had experience with the latter type, which gave results practically identical with those the author had put forward. The paper had seemed to dispose very much of the efforts made on behalf of the mechanical producer. Dr. Smith had given them in simple terms the advantages of a simple producer.

### The Author's Reply.

Dr. Smith, in replying to the points that had been raised, said it was very interesting to hear Mr. Smith give his experiences at

Tottenham with mechanical producers. One could not but entirely agree with his policy. His own feeling was that mechanical producers were not well conceived at Tottenham in the first instance, and were not given their maximum chance. One could not do a thing of that kind half-heartedly. It should have been arranged that the gas should be washed and cleaned and brought down to normal temperature, and then re-heated before use. This made the balance-sheet worse, but it was the proper way. He did not want members to carry away with them the idea that either he or his firm were opposed to mechanical producers in all circumstances. They supplied mechanical producers in their coke oven business. In fact, they were necessary for many plants. Thus all the figures for labour, working costs, and prices were available to his firm, who were just as ready to supply one form as the other. But in spite of this, their views were broadly as had been stated in his paper. He did not think that, because the grate area was large in the step-grate producer, there should be any risk of the by-passing of gas through the producer, and so getting varying compositions of gas and varying thermal efficiencies. The difficulty with mechanical producers was usually that, relatively, they were pressed in their work. The amount of coke burned per sq. foot of grate area in mechanical producers was two to four times greater than in step-grate producers.

One point he would like to mention was the possibility of disposing of effluents on step-grate producers. This was a recommendation of the Effluent Committee and was now being used in many works. Quite a lot of effluent could be disposed of by using it instead of water on the grates. With regard to lining renewals, the producers were built with the idea that the linings could be easily displaced and easily renewed. It was not to be expected that the producer lining would last as long as the retorts, and one must be prepared to re-line them after a reasonable period, which he placed at about two years. He thought a really first-class firebrick would give good results under these conditions. It was a question of cost as well as length of life. As to the dilution of coal gas with producer gas, this was quite an accepted thing. Where gas was being made without any steam, in horizontal retorts, and the retort bench was in very good condition, and it was necessary to conform to a certain calorific value, this was the best means of bringing down gas—it was much better than over-pulling.

There was also the question of steam augmentation. In many works the waste heat boiler did not give quite enough steam to meet the works requirements, and arrangements were now in operation for the producer to supply gas to the inlet of the waste heat boiler, for the purpose of augmenting the supply. This arrangement was working very well indeed. A point had been raised as to the best temperature in the combustion zone, and in reply to this he would say that 1000° was by all means the right tempertaure. In giving a figure of 850°, he referred to the temperature of the gas as it went through the nozzles immediately prior to combustion. Frequently very crude injectors were used, and they did not give the efficiency that they should. When using the correct range of steam pressure the steam air proportions should remain approximately the same. Mr. Richards had made a point of taking records of fuel consumption. Rarely was it possible to get correct figures for fuel consumption, but undoubtedly the speaker who followed was right in saying that if they worked their producers under proper conditions they would get the best results.

Mr. Shadbolt had raised the point of the difference between the sloping-bar grate and the step-grate. If one were to get a bar-grate, and had everything else in the producer the same as the step-grate, very good results should be secured, but the bar-grate would still have one disadvantage. With the step-grate the water dropped from tray to tray and steam passed more evenly through the bed of the producer. This was not possible in the bar type unless a steam injector were used. Another point is that with the bar type of producer—the smaller grades of coke could not be used as they tended to fall between the bars.

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The PRESIDENT proposed a hearty vote of thanks to Dr. Smith.

Mr. J. W. AUCHTERLONIE (Cambridge), seconding, remarked that there was no doubt that the producers of to-day were much more efficient, and gave much less trouble, than was the case a few years ago. The paper would make them all look into their working, and see whether it was possible to make any improvements.

Mr. SHADBOLT, supporting the vote, said he was gratified to find that, though a suggestion of his thirty years ago was decried when he made it, to-day producer gas had proved itself to be one of the cheapest, and in certain circumstances one of the most useful, forms of diluent.

### OFFICE BEARERS.

The following office bearers for 1932 were elected:

*President.*—Mr. P. D. Walmsley, Great Yarmouth.

*Vice-President.*—Mr. W. Grogono.

*New Members of Committee.*—Messrs. B. Clarke, Stamford, and E. F. Keable, Gorleston.

*Auditors.*—Messrs. G. A. Mallett, Ipswich, and W. S. Venner, Brentwood.

*Hon. Secretary and Treasurer.*—Mr. W. C. Chapman, Boston.

Mr. WALMSLEY, acknowledging his election as President, said that, on behalf of his Chairman and co-Directors, he had great pleasure in inviting the members to visit Yarmouth for their meeting in the spring. [Applause.]

The PRESIDENT, referring to the resignation of Mr. Keable, said they all sincerely regretted that he found it impossible longer to carry on the work of Hon. Secretary and Treasurer. He had served the Association exceedingly well, and he wished to thank him personally for the help given during his Presidency.

Mr. KEABLE explained that, since taking over the office four years ago, his other duties and responsibilities had been considerably added to. In addition, it was his view that these offices should go round. It was all to the good of the Association that there should be a change within a reasonable period. He was very glad Mr. Chapman had been appointed to succeed him, as they had been friends since they were schoolboys together.

Mr. J. W. AUCHTERLONIE (Cambridge) proposed the reappointment of Mr. Keable as Education Secretary, as he understood he was willing to carry on this part of the duties for at least another year.

Mr. F. A. WEST (Newark) seconded this, and it was agreed to.

On the proposition of Mr. J. H. TROUGHTON (Newmarket), seconded by Mr. J. B. HANSFORD (Bedford), a hearty vote of thanks was passed to Mr. Keable for the valuable services rendered by him during his Secretaryship.

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## High-Temperature Carbonization.

Dr. E. W. Smith, C.B.E., F.I.C., Technical Director of the Woodall-Duckham Companies, gave a public lecture at the St. John Cass Technical Institute on Monday evening, Oct. 12, the Chairman being Sir David Milne-Watson, D.L., LL.D., Governor of the Gas Light and Coke Company.

In introducing his subject, Dr. Smith stated that his lecture itself inaugurated a course in Coal Carbonization organized by one of the best known of our Technical Institutes. As one who had for some time been closely in touch with the Sir John Cass Technical Institute, he was in a position to know that the course was well conceived, comprehensive, and ample for the needs of serious students who desired to be kept abreast of the times in all that related to fuel technology. His pleasure was all the more enhanced by the knowledge that, at great personal sacrifice, the Chairman was present in order to indicate that such work as was undertaken at the Institute had his fullest encouragement and support.

The lecturer said that he believed the future of the industry depended largely on those who have a scientific training and applied it to the problems of gas and coke production, organization, sales, distribution, finance, purchasing, and last, but not least, psychology in all its branches. He had two objects in his lecture. First, to stimulate the imaginations of the students who were present by demonstrating to them the fascinating technical possibilities of the subject, and, secondly, to draw their attention to the fact that in Industry the one question of primary importance that every technician—as distinct from the pure scientist—should put to himself when tackling any problem was, What will be the effect on the cost? In the Gas Industry the ultimate problem was always, How can gas be supplied to the consumer, under correct conditions, at the cheapest cost?

Dr. Smith then proceeded to outline the principles of coal carbonization, and traced the development of carbonizing plants from the early cast-iron horizontal retort to the modern high-temperature carbonizing plant constructed of silica, either in the form of continuous vertical retorts, horizontal retorts, or in intermittent vertical chambers and coke ovens.

The lecturer then proceeded to discuss the types of producers employed in heating carbonizing plants. He had often in recent years made exhaustive study of the relative advantags of step-grate producers, such as he had described, with mechanical producers. The advantages of cold clean gas under positive pressure could not be overlooked. Nevertheless, when all costs were taken into account, he had never been able to justify their adoption.

Dr. Smith also discussed the subject of benzole washing. With the advantage of the 8d. a gallon tax, carbonizing engineers would, he said, be examining more closely the economics of benzole recovery. In his opinion, much more benzole washing was justified than was taking place to-day. If benzole washing were adopted, either the standard of calorific value would have to be reduced about 10 to 13 B.Th.U. per gallon extracted, or the quality of the unwashed gas made would have to be increased a like amount. The latter method would, in his view, be the better.

He urged that more attention should be paid to the purchase of low ash coal for coke production. Low ash coals cost more, but the extra thermal yield was there, and an enhanced price could be readily commanded for the coke.

XUM

# Hydrogenation

[Discussion on Dr. W. R. Ormandy's Paper before the Institute of Fuel on Oct. 7—see last week's "JOURNAL"]

Dr. C. H. Lander (representing the Fuel Research Board) reviewed some of the past history concerning the hydrogenation of coal for the purpose of producing petrol, and said this was one of the most striking discoveries and developments which had occurred for many years. It was well known before the war that Dr. Bergius had evolved a process for converting coal into oil, and soon after the war the Fuel Research Board investigated some of the rather curious claims that had been made in regard to it in the Press. Experiments were put in hand in 1920 at the Fuel Research Station at East Greenwich, and in 1925 a Syndicate was formed in this country to investigate the claims for hydrogenation as far as its applicability to British coal was concerned. This Syndicate was organized by Dr. Ormandy. After a time Dr. Ormandy approached the Department of Scientific and Industrial Research for help, stating that the Syndicate had exhausted all its money, but that it had certain options with regard to patent rights. As a result two representatives of the Government visited Germany with Dr. Ormandy, and the net result was that the Syndicate was subsidized on the £ for £ basis to a possible maximum of £25,000 by the Department of Scientific and Industrial Research. Those who made this visit to Germany—and he hoped that his German friends would not take this remark unkindly—found that the work on the process that had been done there was not of the usual thorough German type. It was very sketchy; the German group had been living from hand to mouth, and had been compelled to produce plausible results in order to secure further funds.

The work carried out in Germany on behalf of Great Britain was under the control of a Committee of which Dr. Ormandy was a member, together with two representatives of the Government, another representative of the British Bergius Syndicate, and Dr. Bergius himself. Within eighteen months it became apparent that British coal could be hydrogenated to produce a large quantity of liquid product, but all that could be said was that the solid had been made into a liquid which was a very unpromising material. This much having been definitely proved, Imperial Chemical Industries acquired a large controlling interest in the British Bergius Syndicate, and had since carried out a splendid piece of work on a really large scale, producing 160 gallons of refined, water-white spirit from each ton of coal treated—not from each ton of coal used. At the same time, work which had been carried out at the Fuel Research Station confirmed up to the hilt the technical claims of I.C.I., and an examination of the Company's books also confirmed a financial claim as far as they could reasonably be deduced from the results of what was not really a full commercial plant. While he had not been able to confirm the claim that petrol could be made from British coal by hydrogenation at a cost of 7d. per gallon, he had checked a figure of 8d. or 9d. per gallon. In this matter we were now in advance of other countries, and the work on the process should undoubtedly be kept alive because, although there was a flood of natural oil available at present, they did not know what would happen in the future, and they must have at the back of their minds the question of national defence and the possibility of circumstances in which they might not be able to obtain oil from abroad.

Exhibiting some samples of the tar produced by coal hydrogenation, and some of the products from the tar, Dr. Lander said that from a ton of coal there could be produced 22·7 gallons of low-temperature tar. If treated by the ordinary process of distillation there could be obtained 1½ gallons of petrol, a certain amount of an oil which might be a fuel oil, and a large percentage of pitch. If the tar were treated with hydrogen in the presence of a catalyst at high pressure, it was transformed to an absolutely transparent liquid. The amount of this liquid produced from the 22·7 gallons of tar was 23·4 gallons, so that there was an increase in bulk, hydrogen having been put into it which made it lighter. That liquid, when again fractionated in a rough way, yielded 15 gallons of petrol, 6·6 gallons of an oil which for the moment he called a Diesel oil, and a product which was called a lubricating oil, but it had not yet been fully examined. He mentioned all this in order to give some idea of what could be done in the direction of hydrogenating coal.

### A Question of Policy.

Prof. W. A. Bone, F.R.S. (representing the Chemical Society), while emphasizing the importance of continuing this work so that the results should not be lost, expressed the doubt whether it was the right policy for this country—a coal country—to convert coal by means of expensive processes into oil. His view was that it should be possible to make coal do a great deal of what oil was doing at present, and he refused to believe that it was beyond the resources of science first to de-ash coal substantially, and, secondly, to explode in an internal combustion engine a flour-fine de-ashed coal as well as they could explode an oil spray.

### Work at Billingham.

Mr. K. Gordon (Imperial Chemical Industries), in thanking Dr. Lander for what he had said with regard to the work at Billingham on hydrogenation of coal, said this was the first time that a Government representative had come into the scheme and found that the estimates put forward by other investigators were not wanting; in other words, Dr. Lander had stated that the I.C.I. were speaking the truth with regard to their results; and he was very much obliged to him for publicly recording that point of view. At the present time we imported 10 million tons of oil annually, of which 3 million tons was petrol. The price of petrol had varied considerably from time to time, but from the figures for 1929 he calculated that, if petrol were imported at 3½d. per gallon, there would be no profit for the oil companies. At 5d. per gallon the profit would be 7½ p.ct., and at 6d. per gallon it would be 10 p.ct. The technical problem, therefore, which had to be faced was the production of petrol at (say) 5d. per gallon from coal costing 13s. to 15s. per ton delivered at site. When discussing the question of making oil from coal they must recognize that hydrogenation was not so much the best way; it was the only way.

In considering the application of this process, three questions presented themselves: (*a*) Should they hydrogenate coal or the tars made from coal; (*b*) was the process sufficiently developed for the immediate application on a large scale; and (*c*) at what cost could the oil be made, and what chance was there of reducing it by future research work? It had been found that petrol could be made from coal at a cost of 7d. per gallon. The cost of making petrol from tars depended on the price at which the tars were obtainable. At £2 per ton petrol could be made at 7d. per gallon, and if tars could be obtained at or about this price then they should form the raw material for hydrogenation. If the price was above this, it was better to proceed directly from coal. The proper course to pursue, however, was to build a plant for the hydrogenation of coal, because the same plant could treat tars when the price of the tars was suitable. A plant built specifically for tar hydrogenation could not be used for hydrogenating coal without considerable alteration. An exactly similar proposition was the preparation of tars for hydrogenation by low-temperature carbonization. With domestic coal as the main feature, this tar became a bye-product and its hydrogenation should be done in the same way as ordinary tar, but it required 4·35 tons of coal per ton of petrol as against 3·65 tons for direct hydrogenation of coal. Summing up the position, Mr. Gordon said that where tars were likely to become available at £2 per ton they should be hydrogenated, but the main part of home-produced oil fuel should be made by the direct hydrogenation of coal.

Continuing, Mr. Gordon said there was a plant in Germany producing 100,000 tons of petrol per year from brown coal tar, and two large plants in America hydrogenating crude oil. For bituminous coal there was the experience at Billingham with a 15-ton per day plant which had been in operation for nearly two years. Schemes had been prepared for plants treating 1000 tons of coal per day and producing 210,000 tons of petrol per annum. Such a plant, allowing for all contingencies, working capital, and interest during the construction period, would cost £8,000,000. Only about one-quarter of this expenditure represented items which were novel; all the rest were covered by existing practice in industry. Smaller plants were definitely not recommended because of the inability to achieve minimum operating costs. The estimate of the cost of petrol made on a plant of this size was 7d. per gallon, compared with the present imported price of 2½d. per gallon. The estimate for the future for oil so made in this country was 5d. per gallon. Petrol made at 7d. per gallon could be retailed at the present market price of petrol, after allowing for retailer's profit, cost of distribution, and a reasonable return on the capital of the coal hydrogenation process.

### A Better Method of Attack.

Dr. W. M. Travers, F.R.S. (Bristol University), in a communication which was read to the meeting, said that throughout the carbonizing industry generally there was a misunderstanding as to the difference between the testing of plant and materials on the one hand, and scientific and technical research on the other; and these two processes were sometimes confused in Dr. Ormandy's paper. During the past few years the results of tests of carbonizing plants had been published by a number of workers, and these provided information of two kinds only. They told something about the working efficiency of proprietary plant, commonly with a slight bias in favour of the maker, and were never critical of scientific and technical defects. He had similar criticism to make of a good deal of the work now being carried out on the hydrogenation of coal which consisted in the application of methods—for the most part worked out and patented in Germany—to the hydrogenation of British coal. It must be recognized that the process of hydrogenation of the materials contained in coal was very complex. It involved the direct reduction of unsaturated compounds, it inhibited condensation processes which would give rise to the formation of tars from primary products, it influenced the splitting of large molecules into smaller molecules, and, lastly, it was consumed wastefully in side reactions which yielded low hydrocarbons

such as methane. It was possible that, by a happy chance, real progress might result from the direct study of the hydrogenation of coal, but it seemed more likely that the better method of attack would be to sort out the constituents and investigate each of them individually.

### Production of Enriching Materials.

Mr. W. M. Selvey, representing the Institution of Electrical Engineers, said the general line of attack was to develop the processing of coal with the purpose of up-grading various fractions. Any work done on coal must be paid for by the increased value of the up-graded fraction. The principal processes of up-grading to-day were the production of electricity and the production of gas and coke. The production of electricity destroyed the coal, but produced (say) a fifth of the original potential energy in a form up-graded to the highest extent known to human endeavour. No promise was yet held out of a direct conversion. The Gas Industry graded up about a quarter of the coal into gas, also an extraordinarily flexible and valuable fraction, with a narrower field but still sufficiently wide to be of inestimable benefit to mankind. It was left with a residue of three-quarters slightly up-graded, but, being largely in competition with the raw product, provided but little comparative return. Could it still further be processed it might increasingly replace the raw material. From a national standpoint it was at the moment regrettable that the only scheme in the field—viz., of converting it to water gas and enriching it—involved the purchase of oils from abroad. It was sincerely to be hoped that means would be found of hydrogenating the distillation products in sufficient quantity to afford all the enriching materials necessary. This, in his view, was the field for low-temperature carbonization, which must be fostered by the Gas Industry if it was ever to be of widespread benefit. To provide, however, both enriching material and light spirit in sufficiency would entail doubling the size of that industry, and could only come about by the total abolition of the open coal fire—a sentimental loss to the older generation, but nothing to a new generation which never knew it.

### Low-Temperature Smokeless Fuel.

Col. W. A. Bristow, speaking on behalf of the Low Temperature Coal Distillers' Association of Great Britain, said the author had dealt with low-temperature distillation in a sympathetic and helpful manner, and, although possessing far greater knowledge, had obviously not considered it necessary to indulge in the vague and violent generalizations of a condemnatory character which had sadly marred the utterance of others. Dr. Ormandy had really stated the case for low-temperature carbonization in a most convincing manner. In his remarks he had paved the way for the production and use of low-temperature smokeless fuel, providing that it could be made suitable for the consumer's requirements, and retailed on a large scale at an economic cost. Several questions had been raised as to points that should receive attention in the manufacturing and marketing of low-temperature smokeless fuel. For instance, the author stated that the ash should not exceed a maximum of 8 p.ct., and this was actually being adhered to throughout the country to-day, and the public found no difficulty in lighting low-temperature smokeless fuels without the assistance of any auxiliary devices such as gas burners. Indeed, there was no need to consider the effects on the coke of an increase in moisture from 4 p.ct. to 16 p.ct. The satisfactory manner in which the various technical difficulties had been overcome could probably best be judged by the fact that at the present moment there were 2000 distributors of low-temperature smokeless fuel in Great Britain, and the supply was insufficient to satisfy an ever-increasing demand, in spite of what appeared at first sight to be the high price obtained for the product. There was also no difficulty in the storage of low-temperature smokeless fuel. Its capacity for absorbing moisture was small, it dried rapidly, and it could be stored in the open for a year without appreciably deteriorating its lighting and burning qualities. Dr. Ormandy raised another important point—viz., what would happen to the price of small coal if low-temperature carbonization were greatly increased in extent. A coal price war with the collieries was even foreshadowed. The vital point to remember was that the average price obtained to-day for all coal, including best house coal at one end and slurry at the other, was very often only about 11s. or 12s. per ton, at which price the whole lot could be carbonized at a profit, not only to the producer, but to the nation by the reduction in the smoke evil, the greater amount of coal mined, and the large saving in the national oil bill.

He had had no personal experience of the hydrogenation of solid coal, but hoped that something would be done in that connection, because the low-temperature industry would be benefited thereby, as there would be hydrogenation works available which could turn to the best possible account the large quantities of coal oil rendered available by the operations of low-temperature plants. Referring to the hydrogenation of low-temperature oils, Col. Bristow exhibited a sample of the crude motor spirit obtained by the hydrogenation of the middle oil fraction of low-temperature crude. The yield by volume was over 90 p.ct., and the crude spirit was remarkably good, requiring only washing. What had already been done definitely indicated that hydrogenation and low-temperature carbonization were allied processes complementary to one another, and in no sense competing, and the low-temperature industry would do everything possible to forward the development of this branch of the industry. As Dr. Ormandy had pointed out, the I.G. in Germany had produced 100,000 tons of petrol per year from coal tar. At the present rate, a similar production in this country would enjoy a preference of one million pounds sterling in the duty, an attractive proposition and thoroughly warranted by the question of national economy.

Mr. H. Clifford Armstrong (Messrs. Thomas Firth & John Brown, Ltd.) said that one of the happiest moments of his life was when he read recently that the Chemistry Section of the British Association had definitely stated that the low-temperature carbonization as an economic proposition was dead. He considered that a very fine piece of work. In a plea for hydrogenation, he said he was still looking forward to the time when the Department of Scientific and Industrial Research would be a help to industry, and he believed it could help enormously in this direction. One or two people should be provided with Government money for the purpose of carrying out the necessary experiments, and the problem of extracting oil from coal ought to be put before the public in a more honest way than low-temperature carbonization had ever been.

### A National Fuel Committee.

Dr. E. W. Smith (representing the Institution of Chemical Engineers) remarked that a fascinating point made in the paper was the possibility of hydrogenating oils in the Gas Industry, and the importance of placing the industry where the products could be got rid of and where there were facilities for obtaining raw materials. That position in both the gas and coke oven industries should be gone into very seriously by the authorities. Referring to the Fuel Research Board, Dr. Smith spoke highly of the work done by Dr. Lander, but went on to condemn the policy of maintaining the Fuel Research Board under Government control. He urged that the Fuel Research Board, as an entity under Government control, should be abolished, and its work divided up in various directions. Research for the mining industry—the coal survey, &c.—he would put into the hands of a research association for the mining industry. He would put the whole of the carbonizing research for the three industries—high-temperature carbonization, low-temperature carbonization, and coke ovens—in the hands of one research association, and anything else left over should be done by a small *ad hoc* body brought into being as required. At the present time the researches carried out by the Fuel Research Board were, to some extent, isolated from the people who were mostly interested in the details of the problems that were being investigated, and he strongly urged a review of the whole organization of the Fuel Research Board.

Finally, Dr. Smith, with the view of preventing the discussion ending in mere talk, moved: "That the Institute of Fuel be requested to call together a Committee representative of those Institutions largely interested in fuel, to act as a Standing Advisory Committee on all matters affecting the nation's fuel policy." There was at one time, he said, a National Fuel and Power Committee, but that was now dead, although perhaps it had not been buried. The Institute of Fuel should take a grip of the situation—nobody else was doing it—and so impress itself upon the public mind that it would be regarded as a body which on all matters of broad policy could be looked to for advice on fuel matters.

Col. W. A. Bristow seconded the resolution.

The President (Sir David Milne-Watson, D.L., LL.D.), in recommending the resolution, said it would be a great pity if the meeting closed without bringing the paper and the discussion to some purpose. He himself had been a member of the National Fuel and Power Committee, but it had not sat for two years, and he did not think it was at all likely that the members would be called together again. Therefore, the field was open, and there need be no jealousy.

Sir Henry Fowler suggested that the resolution should be put in the form of a recommendation to the Council of the Institute to consider the proposition and take the necessary action if it thought fit.

The resolution, put to the meeting in this form, was carried unanimously.

### The Author Replies.

Dr. Ormandy, who promised a full reply in writing, dealt with some of the points raised in the discussion. The suggestion by Prof. Bone to de-ash coal and use it in fine powdered form in internal combustion engines involved many difficulties, not the least serious of which was the difficulty of carrying such fuel, for instance, on motor-cars.

Commenting on Mr. Gordon's remarks in favour of a large hydrogenation plant, Dr. Ormandy stuck to his view that it would be better to have a 100-ton plant, consisting of two 50-ton units, and to gain experience with that, even if it cost a little more to produce the petrol. As to the suggestion that they should revert to the use of coal in warships, he added the further suggestion that they should revert to the use of bows and arrows!

Replying to Col. Bristow, he contended that if low-temperature carbonization was to become a real national industry its development must take place via the gas-works. As regards Prof. Travers' contribution, Dr. Ormandy expressed the view that the Professor was not in possession of sufficient information as to what was being done with hydrogenation to be able to express definite views in the manner he had with any justification. Probably not 1 p.ct. of the original research work carried out on the hydrogenation of coal and tar was available to the public, and Prof. Travers, possessing the little information that had leaked out—subject to the alterations and variations that occurred during such a leakage—was placed at a disadvantage when he tried to draw deductions as to the nature and value of the work which was being done, and which he did not know about.

# REGISTER OF PATENTS

## Water Gas of Regulated Nitrogen Content. No. 353,522.

THE POWER GAS CORPORATION, LTD., RAMBUSH, N. E., and BALLINGALL, J. M., all of Stockton-on-Tees.

No. 12,893; April 26, 1930.

In the ordinary manufacture of water gas, state the patentees, a small proportion of nitrogen—say, 3-5 p.ct. is present in the finished gas. This amount is not readily regulated as to quantity. This invention relates to the manufacture of water gas of regulated nitrogen content. The range of percentage is from the 3-5 p.ct. mentioned above to (say) 60 p.ct. or thereabouts, the nitrogen content of producer gas. In other words, the invention may be described as one for the production of water gas, or producer gas, or any mixture thereof in controllable amounts in the same apparatus.

A water gas generator is blown alternately with air and a mixture of air and steam, the amount of air in the air-steam mixture being regulated in accordance with the pressure, volume, or rate of flow of the gases leaving the plant.

## Gas Recorders and Regulators.—No. 353,948.

MILLS, T. A., of Saltburn-by-the-Sea, and BOSANQUET, W. S. B., of Darlington.

No. 13,326; April 30, 1930.

This invention relates to automatic gas regulating apparatus of the kind comprising a pressure bell which is connected to the gas main so as to be sensitive to the differences of pressure across a restriction therein, means being provided for counterbalancing the bell so that its movements may be translated into terms other than those of pressure and may be recorded, and for utilizing the movements to actuate a valve controlling the flow in the main.

The object is to provide a simple form of apparatus in which the movement of the bell is utilized to control means for maintaining the flow of the gas at any desired rate, the bell having no mechanical connection with the flow maintaining means, so that the accuracy of its movements is not affected. Another object of the invention is to provide means whereby the readings of the scale are rendered more accurate and readily ascertainable.

The apparatus comprises a pressure bell which is counterbalanced by a variable weight in such a manner that the resultant movement of the bell under pressure difference changes may be made to follow any desired law of variation of the differential pressure, while the bell is connected to a contactor reversing switchgear which is adapted to close one of two circuits when the bell moves, to open or close a valve in the gas main.

The bell may also be operatively connected to a movable pen adapted to move over a recording drum, the pen preferably comprising a pivoted frame on which is mounted a toothed sector meshing with a rack which is moved with the bell, and a second pivoted frame mounted eccentrically of the said frame. The eccentric frame carries the pen proper and is slightly overbalanced so as to be made to press against a cam surface on the main pivoted frame, which surface is so shaped that the movements of the bell are transposed into pen movements corresponding to the square root of the pressure difference values indicated by the bell movements, so that the pen movements are in terms of volume.

The connection between the bell and the electric control gear is preferably adjustable so that it may be set for any desired flow of gas.

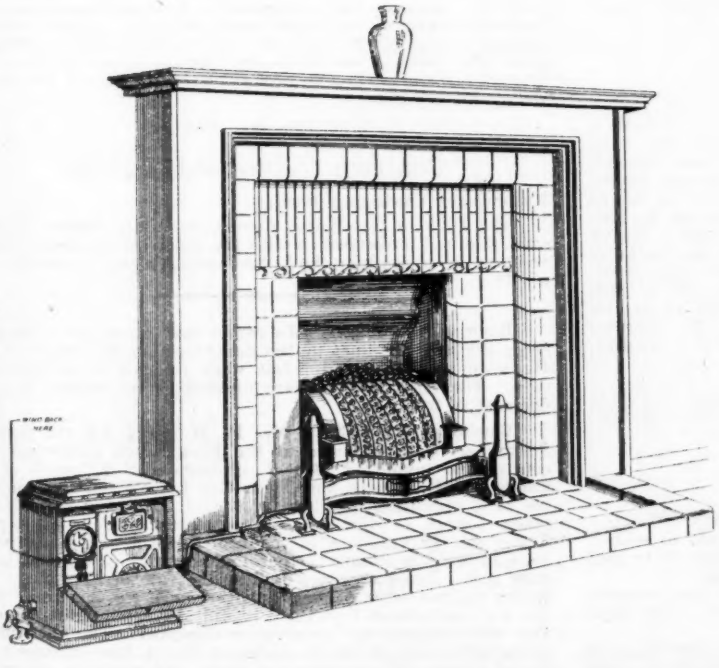
## Gas Acts (1920 and 1929) Orders.

SPECIAL ORDERS.

Walton-on-Thames and Weybridge Gas Company.

To empower the Company to grant pensions to employees, to establish and maintain a pension fund, and to make provisions as to anti-fluctuators to be used with gas engines.

A VULCAN "COMFY" GAS FIRE and a WILLEY METER make up



WILLEY COMFORT

A meter is never more welcome than when it is a means of providing radiant heat in a cheerless apartment. Such installations are profitable to all concerned, to the Gas Undertaking, the Hotel Proprietor and his Guest.

DON'T HESITATE

*Let us quote for complete installations*

WILLEY & Co., Ltd.
*Makers of Everything for Gas*
EXETER

London, Manchester, Leicester, Darlington, etc.

# GAS MARKETS & MANUFACTURES

## Stock Market Report.

**[For Stock and Share List, see later page.]**

It is only to be expected that until the Election is over business on the Stock Exchange will be limited in volume, and a general curtailment of commitments was in evidence again last week. Confidence in the result, however, increased steadily day by day, and at the close prices in most sections displayed remarkable firmness. Home Rails and the more popular Industrials were particularly strong features, and in many instances substantial improvements in value were recorded over the previous week.

Gas stocks and shares were well supported, and prices for the most part remained firm. It is gratifying to note that the debenture stocks of the Gas Light and Coke and South Metropolitan Companies which were marked down a few weeks ago showed further improvement last week, the latter Company's 5 p.ct. gaining 3 points to 98. It will be seen from the Stock and Share List that a contraction in the margin from 10 to 5 points was responsible for a drop in value of severel debenture and preference issues, though actually business was done at slightly higher prices than the previous week. The only depreciations of any note were in Maidstone ordinary, with a fall of 4 points to 125½, and Tottenham 5½ p.ct. preference which declined 5 points to 95½. On the other hand, Newcastle £1 units hardened 3d. to 16s. at the local Exchange, and European rose 2 points to 107.

As an instance of the popularity of, and confidence in, "gas" as an investment, it is interesting to note that at a sale recently parcels of the Cambridge Gas Company's original stock (10 p.ct. maximum) and "B" stock (7 p.ct. maximum) realized the highest prices obtained for these stocks since the war. The 10 p.ct. stock sold at £182 p.ct. and the "B" stock up to £137 p.ct. The maximum dividends on these stocks have been paid each half-year since 1900.

## Current Sales of Gas Products.

### The London Market for Tar and Tar Products.

LONDON, *Oct.* 19.

The prices of tar products remain steady, and there are no changes to report.

To-day's values are: Pitch, from 60s. to 65s. per ton f.o.b.; creosote, for export, varies from 3¾d. to 5d. per gallon f.o.b. according to specification; pure toluole, 1s. 11d. to 2s. per gallon; pure benzole, about 1s. 5d. per gallon; '95/160 solvent naphtha, about 1s. 5d. to 1s. 6d. per gallon.

Pyridine bases are 3s. 3d. to 3s. 6d. per gallon.

### Tar Products in the Provinces.

*Oct.* 19.

The average prices of gas-works products during the week were: Gas-works tar, 21s. to 25s. Pitch—East Coast, 52s. 6d. to 53s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 52s. 6d. to 53s. 6d. f.o.b.* Toluole, naked, North, 1s. 8d. to 1s. 8¼d. Coal-tar crude naphtha, in bulk, North, 5d. to 5¼d. Solvent naphtha, naked, North, 1s. 3d. to 1s. 3½d. Heavy naphtha, North, 11d. to 11½d. Creosote, *ex* works, in bulk, North, liquid and salty, 3¼d. to 3½d.; low gravity, 1¼d.; Scotland, 3¼d. to 3½d. Heavy oils, in bulk, North, 5d. to 5¼d. Carbolic acid, 60's, 1s. 6d. to 1s. 6½d. Naphthalene, £9 to £10. Salts, 50s. to 70s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

### Tar Products in Scotland.

GLASGOW, *Oct.* 17.

Inquiries are numerous, but distillers are not anxious sellers, particularly for forward delivery. There is not likely to be any great change here until after the General Election.

Pitch.—Only small quantities are on offer, and value is higher at 47s. 6d. to 50s. per ton f.o.b. Glasgow for export. The home value is 45s. per ton *ex* works.

Refined tar to Ministry of Transport Specification is now valued at 3d. to 3¼d. per gallon, and prompt supplies are still difficult to obtain.

Creosote oil.—While quotations are unchanged there is a better feeling prevalent. B.E.S.A. Specification is 2¾d. to 3d. per gallon; low gravity, 3¼d. to 3½d. per gallon; and neutral oil, 3¼d. to 3½d. per gallon—all f.o.r. in bulk.

Cresylic.—This product remains rather disappointing, although prices are unchanged. Pale, 97/99 p.ct., is 1s. 3d. to 1s. 4d. per gallon; dark, 97/99 p.ct., 1s. 2d. to 1s. 3d. per gallon; and pale, 99/100 p.ct., 1s. 5d. to 1s. 6d. per gallon—all *ex* makers' works.

Crude naphtha is commanding 4½d. to 5d. per gallon, according to quality.

Solvent naphtha.—Market continues quiet. 90/160 is 1s. 3d. to 1s. 4d. per gallon, and 90/190, 1s. to 1s. 1d. per galon.

Motor benzole is in moderate request at 1s. 3d. to 1s. 4d. per gallon in bulk f.o.r. works.

Pyridines.—90/160 grade is 2s. 9d. to 3s. per gallon, and 90/140 grade, 3s. to 3s. 3d. per gallon.

### Benzole Prices.

These are considered to be the market prices for benzole at the present time:

| | s. | d. | | s. | d. | |
|---|---|---|---|---|---|---|
| Crude benzole | 0 | 7 | to | 0 | 7½ | per gallon at works |
| Motor " | 1 | 2 | " | 1 | 3 | " " " |
| Pure " | 1 | 6 | " | 1 | 7 | " " " |

## Trade Notes.

### A Catalogue of "Harco" Products.

From Messrs. G. A. Harvey & Co. (London), Ltd., we have received a copy of their new abridged catalogue (No. 525) which covers a wide range of products manufactured by the firm.

### New Gasholder for Dunbar.

The Dunbar Town Council have decided to carry out important alterations and improvements at their gas-works, and they have accepted the offer of Messrs. R. Dempster & Sons, Ltd., of Elland, Yorkshire, for the erection of a new gasholder at a cost of £3008, and subject to the Unemployment Grants Committee approving of the work.

### Evered Gas Fittings.

From Messrs. Evered & Co., Ltd., of Surrey Works, Smethwick, we have received their catalogue (No. 175) of gas fittings of all descriptions. The publication is divided into sections embracing cocks, unions, and small fittings; geyser fittings, examples of standard, bracket, and pendant lighting fittings; glass, silk shades, wood blocks, &c. An interesting section gives illustrations and particulars of the "Everite" burner for private and public lighting.

## Contracts Advertised To-Day.

### Washing and Condensing Plant.

The Oldham Gas-Works Committee invite tenders for the work required in connection with the construction, delivery, and erection of a washing and condensing plant. [Advert. on p. 216.]

**Heywood Gas Report.**—We regret that owing to a printers' error the last five lines of the paragraph on the report of the Heywood Gas Undertaking last week referred to another concern. The report should have finished at the words "... a decrease of 3·86 p.ct."

**Cambridge Stock Sale.**—Mr. P. W. Gray (of the firm of Scruby & Gray) attended at the Lion Hotel, Cambridge, recently, and submitted £400 of consolidated "B" stock of the Cambridge University and Town Gas Light Company, entitled up to a maximum dividend of 7 p.ct., and £50 consolidated original stock entitled up to a maximum dividend of 10 p.ct. There was an excellent attendance, and the maximum prices realized were as follows: Consolidated "B" stock sold up to £137 p.ct. Ten p.ct. stock sold at the rate of £182 p.ct. The prices realized were the highest ever made for this stock since the war, and shows that there is still a great interest taken in this well-managed and progressive Company. The auctioneers, whose offices are at 29, St. Andrew's Street, have a large number of clients still requiring gas stock, and would be pleased to hear from shareholders desirous of disposing of their stock.

# STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

| Issue. | Share. | When ex-Dividend. | Dividends. Prev. Hf. Yr. | Dividends. Last Hf. Yr. | NAME. | Quotations. Oct. 17. (Provincial Exchanges Oct. 16.) | Rise or Fall on Week. | Transactions. Lowest and Highest Prices During the Week. |
|---|---|---|---|---|---|---|---|---|
| £ | | | % p.a. | % p.a. | | | | |
| 1,551,868 | Stk. | Oct. 5 | 7⅛ | 7⅛ | Alliance & Dublin Ord. ... | 100—105* | ... | 102½—103½ |
| 374,000 | ,, | July 9 | 4 | 4 | Do. 4 p.c. Deb. ... | 67—72 | ... | ... |
| 522,655 | ,, | Aug. 24 | 7 | 7 | Barnet Ord. 7 p.c. ... ... | 121—126 | ... | ... |
| 300,000 | 1 | Apl. 23 | 1/4⅛ | 1/9⅛ | Bombay, Ltd. ... ... | 15/—17/6 | ... | ... |
| 174,500 | 10 | Aug. 10 | 9 | 9 | Bournemouth 5 p.c. ... | 14⅜—15⅜ | ... | 15½—15⅜ |
| 500,050 | 10 | ,, | 7 | 7 | Do. B 7 p.c. ... | 12—13 | ... | ... |
| 439,160 | 10 | ,, | 6 | 6 | Do. Pref. 6 p.c. ... | 10½—11½ | ... | ... |
| 50,000 | Stk. | June 25 | 3 | 3 | Do. 3 p.c. Deb. ... | 55—60 | ... | ... |
| 162,025 | ,, | ,, | 4 | 4 | Do. 4 p.c. Deb. ... | 75—80 | ... | ... |
| 357,900 | ,, | Aug. 24 | 7½ | 7½ | Brighton & Hove 6 p.c. Con. | 114—119 | ... | 115 |
| 371,880 | ,, | ,, | 6⅔ | 6⅔ | Do. 5 p.c. Con. | 104—107 | ... | 104 |
| 1,287,500 | ,, | July 23 | 5 | 5 | Bristol 5 p.c. max. ... ... | 90—93[a] | ... | ... |
| 120,420 | ,, | June 25 | 4 | 4 | Do. 1st 4 p.c. Deb. ... | 78—80[a] | ... | ... |
| 217,870 | ,, | ,, | 4 | 4 | Do. 2nd 4 p.c. Deb. ... | 78—80[a] | ... | ... |
| 328,790 | ,, | ,, | 5 | 5 | Do. 5 p.c. Deb. ... ... | 98—99[a] | ... | ... |
| 855,000 | ,, | Oct. 5 | 8 | 7 | British Ord. ... ... ... | 107—112* | ... | 109½ |
| 100,000 | ,, | June 25 | 7 | 7 | Do. 7 p.c. Pref. ... ... | 110—115 | ... | ... |
| 120,000 | ,, | ,, | 4 | 4 | Do. 4 p.c. Red. Deb. ... | 70—80 | ... | ... |
| 450,000 | ,, | ,, | 5 | 5 | Do. 5 p.c. Red. Deb. ... | 90—100 | ... | 95½—96 |
| 160,000 | ,, | June 25 | 5 | 5 | Cambridge 5 p.c. Deb. ... | 95—100 | ... | ... |
| 100,000 | 10 | May 21 | 6 | 8 | Cape Town, Ltd. ... ... | 9—10 | ... | ... |
| 100,000 | 10 | May 7 | 4½ | 4½ | Do. 4½ p.c. Pref. ... | 6¼—7¼ | ... | ... |
| 150,000 | Stk. | June 25 | 4½ | 4½ | Do. 4½ p.c. Deb. ... | 65—70 | ... | 65—70 |
| 626,860 | ,, | July 23 | 6 | 6 | Cardiff Con. Ord. ... ... | 95—98 | ... | 95⅔—96 |
| 237,860 | ,, | June 25 | — | 2⅜ | Do. 5 p.c. Red. Deb. | 90—95 | −2½ | ... |
| 157,150 | ,, | Aug. 10 | 6½ | 5 | Chester 5 p.c. Ord. ... ... | 85—90[b] | ... | ... |
| 98,936 | 1 | Oct. 5 | †2/- | 2/- | Colombo, Ltd. Ord.... ... | 27/—32/-* | ... | ... |
| 24,500 | 1 | ,, | 1/4⅛ | 1/4⅛ | Do. 7 p.c. Pref. | 17/—19/-* | ... | ... |
| 609,204 | 1 | Apl. 9 | 1/4⅛ | 1/3'27 | Colonial Gas Assn. Ltd. Ord. | 10/—15/- | ... | ... |
| 296,053 | 1 | ,, | 1/7⅛ | 1/5'67 | Do. 8 p.c. Pref. | 10/—15/- | ... | ... |
| 2,078,280 | Stk. | July 23 | 6 | 6 | Commercial Ord. ... ... | 92—95 | ... | 92½—93¼ |
| 475,000 | ,, | June 11 | 3 | 3 | Do. 3 p.c. Deb. ... | 52—57 | ... | 54—56 |
| 787,560 | ,, | Aug. 10 | 7 | 7 | Croydon sliding scale ... | 107—110 | ... | 108—108⅜ |
| 453,100 | ,, | ,, | 5 | 5 | Do. max. div. ... ... | 81—84 | ... | 82½—83½ |
| 542,270 | ,, | Aug. 24 | 10 | 7 | Derby Con. ... ... ... | 120—125[c] | ... | ... |
| 55,000 | ,, | June 25 | 4 | 4 | Do. Deb. ... ... ... | 65—70[c] | ... | ... |
| 209,000 | ,, | Sept. 7 | 5 | 5 | East Hull Ord. 5 p.c. ... | 70—73 | ... | ... |
| 1,002,180 | ,, | Sept. 21 | †6½ | †4 | European, Ltd. ... ... | 102—112 | +2 | 105—110 |
| 18,963,033 | ,, | July 23 | 5⅜ | 5⅜ | Gas Light & Coke 4 p.c. Ord. | 18/3—19/3/ | ... | 18/6—19/1½ |
| 2,600,000 | ,, | ,, | 3½ | 3½ | Do. 3½ p.c. max. ... ... | 52—62 | ... | 55—58 |
| 4,294,691 | ,, | ,, | 4 | 4 | Do. 4 p.c. Con. Pref. ... | 69—74 | −1½ | 70½—73 |
| 5,694,095 | ,, | June 11 | 3 | 3 | Do. 3 p.c. Con. Deb. ... | 54—59 | ... | 56½—58 |
| 3,642,770 | ,, | ,, | 5 | 5 | Do. 5 p.c. Red. Deb. ... | 95—100 | +2 | 96—99½ |
| 2,500,000 | ,, | ,, | — | 4½ | Do. 4½ p.c. Red. Deb. ... | 88—93 | +1 | 88—92½ |
| 161,480 | ,, | Sept. 7 | 10 | 10 | Harrogate Cons. 10 p.c. max. | 157—162 | ... | ... |
| 82,500 | ,, | Aug. 24 | 7 | 7 | Hastings & St. L. 5 p.c. Conv. | 95—100 | ... | ... |
| 258,740 | ,, | ,, | 5½ | 5½ | Do. 3½ p.c. Conv. | 80—85 | ... | ... |
| 70,000 | 10 | 9 Oct. '30 | § | 10 | Hongkong & China, Ltd. ... | 12½—13¼ | ... | ... |
| 213,200 | Stk. | Aug. 10 | 6 | 6 | Hornsey Con. 3½ p.c. ... | 89—92 | ... | ... |
| 2,800,000 | ,, | May 21 | 15 | 25 | Imperial Continental Cap. | 335—355 | ... | 343—354 |
| 223,180 | ,, | Aug. 10 | 3½ | 3½ | Do. 3½ p.c. Red. Deb. | 70—75 | ... | ... |
| 235,242 | ,, | Aug. 10 | 8½ | 8½ | Lea Bridge 5 p.c. Ord. ... | 129—132 | ... | 130—130½ |
| 2,145,907 | ,, | Aug. 24 | 6 | 6 | Liverpool 5 p.c. Ord. ... | 93—94[b] | −1½ | ... |
| 306,083 | ,, | July 15 | 4 | 4 | Do. 4 p.c. Deb. ... | 79—81[b] | ... | ... |
| 165,736 | ,, | Aug. 24 | 9 | 8 | Maidstone 5 p.c. Cap. ... | 123—128 | −4 | 123—124 |
| 63,480 | ,, | June 25 | 3 | 3 | Do. 3 p.c. Deb. ... | 55—60 | ... | ... |
| 75,000 | 5 | June 11 | †10 | †10 | Malta & Mediterranean ... Metropolitan (of Melbourne) | 6⅞—7¼ | ... | ... |
| 392,000 | — | Oct. 1 | 5½ | 5½ | 5½ p.c. Red. Deb. ... ... | 78—83* | ... | ... |
| 171,978 | Stk. | Aug. 24 | 5 | 5 | M. S. D. Utility "C." Cons. | 76—81 | ... | ... |
| 522,992 | ,, | ,, | 4 | 4 | Do. 4 p.c. Cons. Pref. | 73—78 | ... | ... |
| 675,000 | ,, | May 21 | †6 | †6 | Montevideo, Ltd. ... ... | 80—90 | ... | ... |
| 9,061,315 | ,, | Aug. 10 | 5⅞ | 5 | Newcastle & Gateshead Con. | 15/6—16/6d/ | +-/3 | ... |
| 682,856 | ,, | ,, | 4 | 4 | Do. 4 p.c. Pref. ... | 71—72[d] | −3 | ... |
| 691,705 | ,, | June 25 | 3½ | 3½ | Do. 3½ p.c. Deb. ... | 69—71[d] | ... | ... |
| 277,285 | ,, | May 7 | 5 | 5 | Do. 5 p.c. Red. Deb. | 98—100[d] | ... | ... |
| 199,940 | ,, | Aug. 24 | 7½ | 7½ | North Middlesex 6 p.c. Con. | 105—110 | ... | ... |
| 396,160 | ,, | Aug. 10 | 5 | 5 | Northampton 5 p.c. max. ... | 74—79 | ... | ... |
| 300,000 | ,, | Apl. 23 | 9 | 7 | Oriental, Ltd. ... ... | 93—103 | ... | ... |
| 60,000 | 5 | 18 May, '15 | — | — | Ottoman ... ... ... | 0—¼ | ... | ... |
| 205,162 | Stk. | June 25 | 8 | 8 | Plym'th & Stonehouse 5 p.c. | 110—115 | ... | ... |
| 434,416 | ,, | Aug. 24 | 8 | 8 | Portsm'th Con. Stk. 4 p.c. Std. | 119—124 | ... | ... |
| 241,446 | ,, | ,, | 5 | 5 | Do. 5 p.c. max. ... | 76—79 | ... | ... |
| 686,312 | ,, | July 23 | 4 | 4 | Primitiva 4 p.c. Rd. Db. 1911 | 83—86 | ... | ... |
| 389,813 | ,, | June 25 | 4 | 4 | Do. 4 p.c. Cons. Deb. | 84—87 | ... | ... |
| 150,000 | 10 | Sept. 21 | 6 | 6 | San Paulo 6 p.c. Pref. ... | 7½—8* | ... | ... |
| 1,736,968 | Stk. | Sept. 7 | 6½ | 6 | Sheffield Cons. ... ... | 103—105[e] | ... | ... |
| 95,000 | ,, | July 9 | 4 | 4 | Do. 4 p.c. Deb. ... ... | 79—81[e] | ... | ... |
| 133,201 | ,, | Sept. 7 | 5 | 8½ | Shrewsbury 5 p.c. Ord. ... | 72—77 | ... | ... |
| 90,000 | 10 | June 11 | †5 | †5 | South African ... ... | 3½—5½ | ... | ... |
| 6,709,895 | Stk. | July 23 | 7½ | 5 | South Met. Ord. ... ... | 97—102 | ... | 99½—100½ |
| 1,135,812 | ,, | ,, | 6 | 6 | Do. 6 p.c. Irred. Pf. | 100—105 | −2½ | 100—104 |
| 1,895,445 | ,, | July 9 | 3 | 3 | Do. 3 p.c. Deb. ... | 54—59 | ... | ... |
| 1,000,000 | ,, | July 23 | 4 | 5 | Do. 5 p.c. Red. Deb. | 93—103 | +3 | 96 |
| 91,500 | ,, | Aug. 10 | 8½ | 8½ | South Shields Con. ... ... | 108—110[d] | ... | ... |
| 1,548,795 | ,, | Aug. 10 | 6½ | 6½ | South Suburban Ord. 5 p.c. | 101—104 | ... | 101⅞—102½ |
| 668,887 | ,, | June 25 | 5 | 5 | Do. 5 p.c. Deb. | 90—95 | −2½ | ... |
| 647,740 | ,, | Aug. 24 | 5 | 5 | Southampt'n Ord. 5 p.c. max. | 76—79 | ... | 76—77 |
| 121,275 | ,, | June 25 | 4 | 4 | Do. 4 p.c. Deb. | 70—75 | −2½ | ... |
| 250,000 | ,, | Aug. 24 | 7 | 7 | Swansea 7 p.c. Red. Pref. ... | 95—98[c] | ... | ... |
| 200,000 | ,, | June 25 | 6½ | 6½ | Do. 6½ p.c. Red. Deb. | 99—102 | ... | ... |
| 1,076,490 | ,, | Aug. 10 | 6⅝ | 6⅝ | Tottenham and District Ord. | 102—106 | −1 | 103—105 |
| 150,000 | ,, | ,, | 5½ | 5½ | Do. 5½ p.c. Pref. ... | 93—98 | −5 | ... |
| 199,995 | ,, | June 11 | 4 | 4 | Do. 4 p.c. Deb. ... | 70—75 | −2½ | ... |
| 85,701 | ,, | Sept. 21 | 6 | 6 | Tuscan, Ltd., 6 p.c. Red. Db. | 72—77* | ... | ... |
| 310,694 | ,, | Aug. 24 | 7 | 7 | Uxbridge, Maidenhead, & Wycombe 5 p.c. ... ... | 100—105 | ... | 102 |
| 88,330 | ,, | ,, | 5 | 5 | Do. 5 p.c. Pref. ... | 88—93 | ... | ... |
| 1,322,220 | ,, | July 9 | 7 | 7 | Wandsworth and District: Consolidated ... ... | 111—114 | ... | 111⅞—112½ |
| 971,373 | ,, | ,, | 5 | 5 | Do. 5 p.c. Pref. ... ... | 87—97 | ... | 95 |
| 1,167,964 | ,, | June 25 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 91—96 | −1½ | 94½—94⅞ |

Quotations as:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. * Ex. div. † Paid free of income-tax. ‡ For year. § Div. = 10 p.ct. p.a. less tax and less tax on interim dividend.

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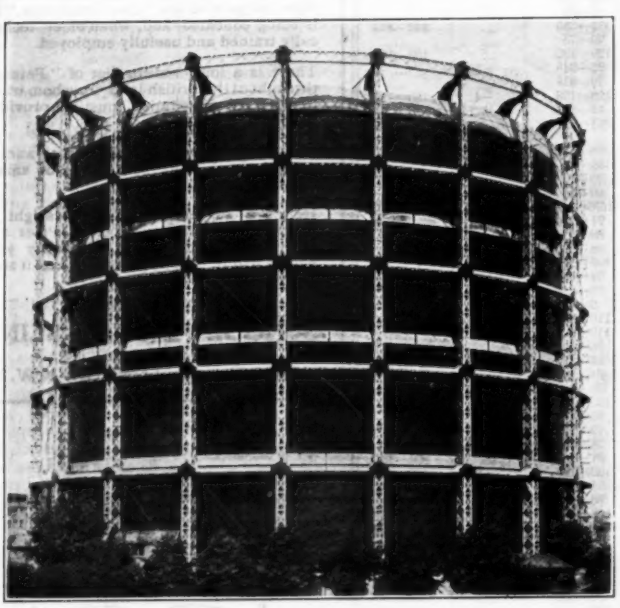

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The person appointed must have received a sound Technical Education, and have a thorough Knowledge of the Design, Construction, and Operation of all Types of Gas Plant. He will be required to assist the Gas Engineer and Manager in all matters pertaining to the Manufacture and Distribution of Gas, and must have Experience in the construction and management of works, and the control of men.

The Salary attached to the post will be from £575 to £750 (the prescribed maximum) per annum, and Candidates, in making Application, must state the commencing Salary, within these limits, which they require.

The successful Candidate will be required to devote the whole of his time to the duties of the office, and to enter into an agreement of service with the Corporation.

The appointment will be subject to the provisions of the Local Government and Other Officers' Superannuation Act, 1922, and to the successful candidate satisfactorily passing a Medical Examination.

Canvassing Members of the Council (either directly or indirectly) will be a disqualification.

Applications, which must include the prescribed form (to be obtained from me), accompanied by *copies* of not more than Three recent Testimonials, and endorsed "Deputy Gas Engineer," should reach me not later than 10 a.m. on Thursday, the 12th of November, 1931.

N. L. FLEMING,
Town Clerk.

Town Hall,
Bradford,
Oct. 7, 1931.

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J. TREVELYAN PHILLIPS,
Clerk to the said Council.

Council Offices,
Tredegar, Mon.,
Oct. 14, 1931.

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J. J. WILLIAMS, LL.D.,
Town Clerk.

Town Hall,
Oldham,
Oct. 14, 1931.

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| Two 30 ft. × 8 ft. 6 ins. × | 160 lbs. | 6970/1 |
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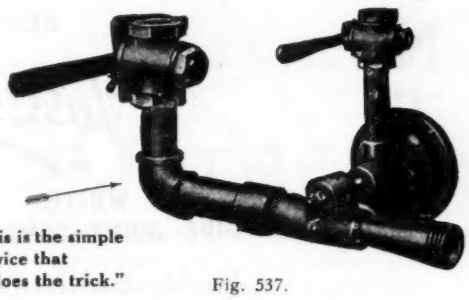

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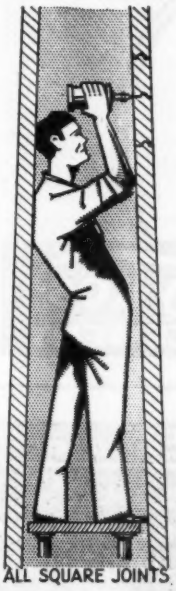

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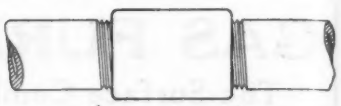

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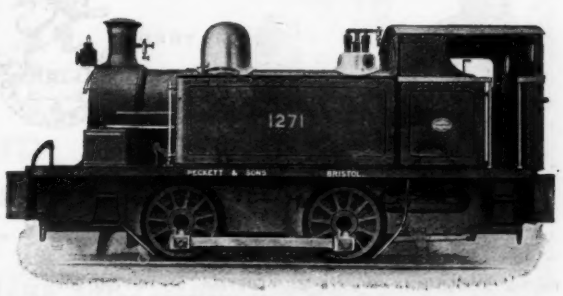

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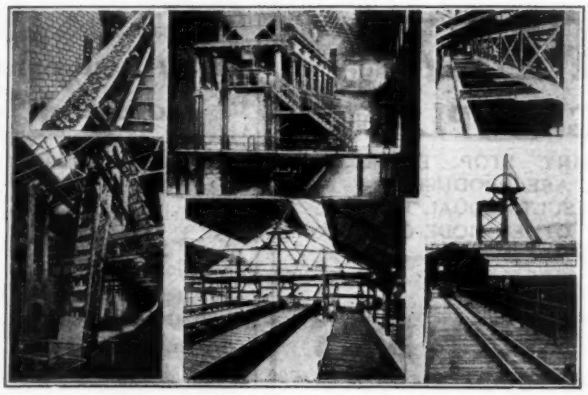

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Fig. 705. "SINGLE RAM" STEAM-PUMP.

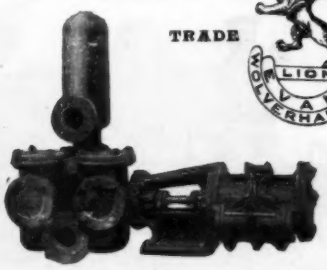

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

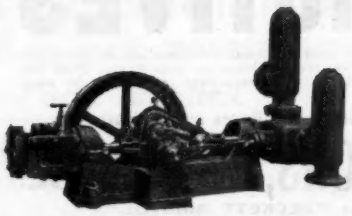

Fig. 685. "RELIABLE" STEAM PUMP FOR TAR AND THICK FLUIDS.

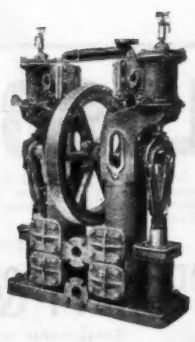

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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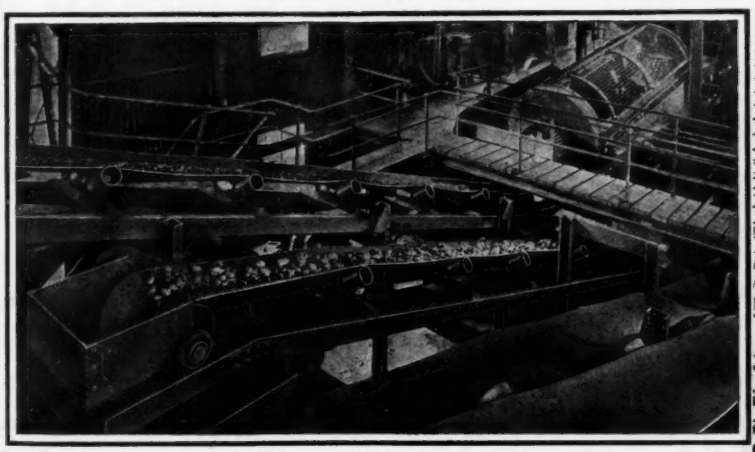

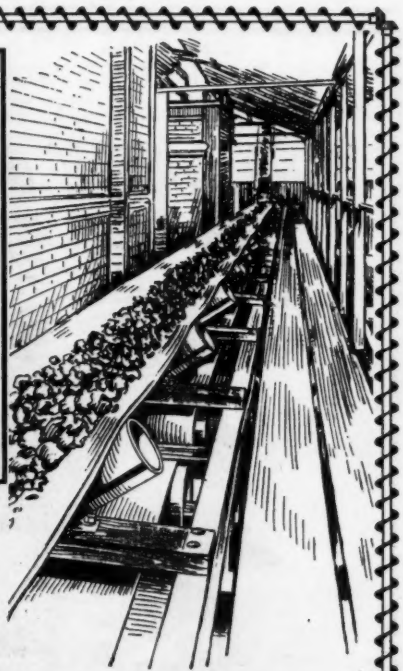

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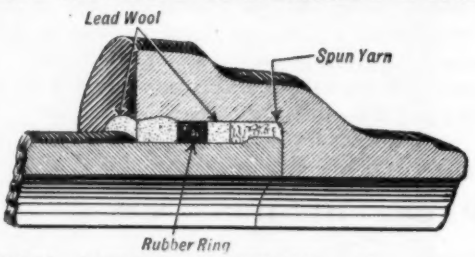


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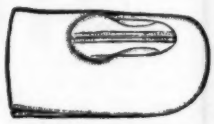

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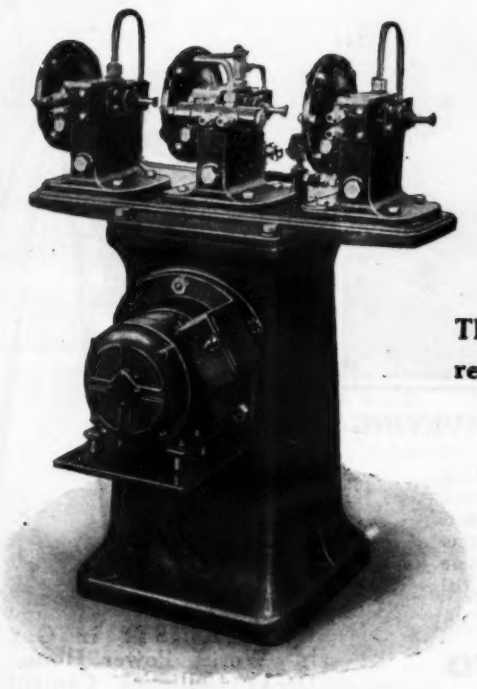

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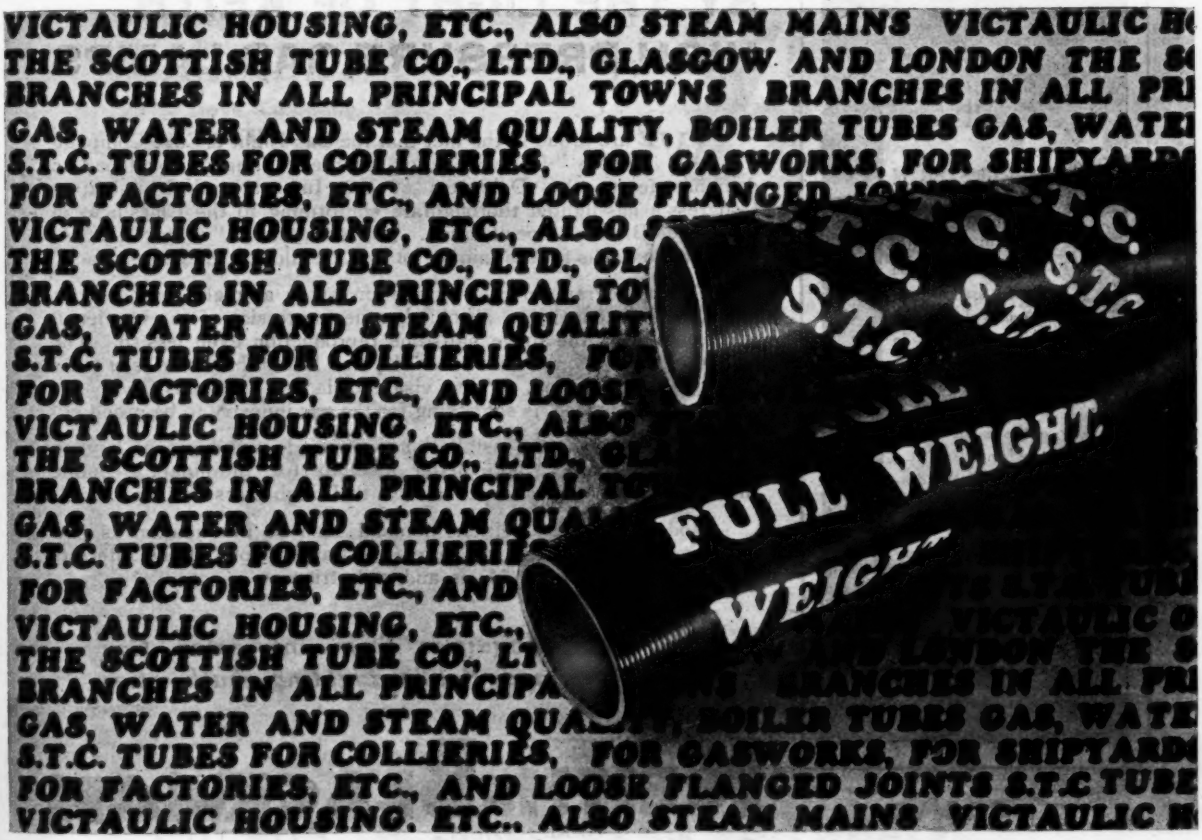
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